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Monographic Studies in Cassia (Leguminosae-Caesalpinioideae)

I. Section Xerocalyx

HOWARD S. IRWIN, JR.

Issued 28 August 1964

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MONOGRAPHIC STUDIES IN CASSIA (LEGUMINOSAE-CAESALPINIOIDEAE)

I. SECTION XEROCALYX[1]

HOWARD S. IRWIN, JR.

The New York Botanical Garden

INTRODUCTION

In the preliminary remarks to his classic revision of the genus *Cassia,* Bentham (1871) states, "The section *Chamaecrista* is an exceedingly puzzling one to botanists. The nicest shades by which the majority of forms pass into each other make it impossible to settle what is to be regarded as a species with any satisfaction." This statement is perhaps more applicable to Bentham's subsection *Xerocalyx* than to any other species group within the section *Chamaecrista.* Amshoff (1939) points out that in *Xerocalyx* certain characters, e.g. leaflet form and size, pedicel length, petal size, and gland stipitation, appear to be independently variable, especially when one examines specimens taken from over a wide area.

The present paper is an attempt to introduce some order into this species complex. The overall problem has taken two phases. The first has been a determination of characters, biochemical, chromosomal, and anatomical, as well as morphological, common to all taxa within *Xerocalyx,* and the comparison of them with comparable traits in other sections of *Cassia.* It is felt that, when taken as a whole, the characters of the group are so distinctive and reflective of such naturalness that failure to recognize *Xerocalyx* as a section would be inconsistent with the present widely accepted infrageneric organization of the genus. The second phase has been an assessment of the specific and varietal taxa in light of the more adequate material now available, and adjustment of entities where appropriate. Judgments have been based on examination of some 2500 herbarium specimens and experience gained in over 10 years of field work in tropical South America. In the present treatment, the section *Xerocalyx* embodies 31 taxa; 16 species and 15 varieties are recognized.

Nonetheless this undertaking must be regarded as preliminary. Great areas in Central and South America are still little explored botanically and there remain enormous tracts which are yet to be visited. This has complicated not only the appraisal of morphological variability but also the determination of geographical distribution. Speculations regarding the latter are difficult to make owing to the paucity of published information on South American geology. Since the present author will be engaging in botanical exploration in tropical South America in years to come, it will be possible in time to reconsider species concepts and other still extant problems in light of populational data, observed distribution, and new patterns of morphological variability thereby gained. It is hoped that eventually the entire genus *Cassia* can be subjected to a comprehensive biological study. No large pantropic genus has yet been so treated.

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[1] Publication of this paper is supported by National Science Foundation Grant No. GN-165.

TAXONOMIC HISTORY

Since the history of the section *Xerocalyx* is intimately connected with that of *Cassia,* it will be useful to briefly document the history of the genus. Although the first occurrence of the words "cassia" and "senna" in literature is not known, it is clear that their use predates the time of Christ. The Greek *κασσια* (or *κασια*) was used by Theophrastus in connection with a description of the medicinal qualities of what is now recognized as *Cassia acutifolia* L. Later Dioscorides applied it to the bark of what is currently called cassie, or the cassia-bark tree, *Cinnamomum cassia* Blume, and to other species of the Lauraceae. These were rather specific references made during a period when the word carried the general connotation "useful plant." Etymologically the Greek is presumed related to, if not derived from, the Old Hebrew *qātsa,* "to cut off" or "to peel off." Thus, in ancient times there was some confusion over the application of the term.

As knowledge of other plants obviously similar to *Cassia acutifolia* was gained, it seems that the Latin *cassia* came to be used for all of them. In any case, Dodonaeus (1553) and Matthiolus (1554) both used *cassia* generically and in the sense eventually adopted by Tournefort and Linnaeus.

"Senna" is the latinized Arabic *saná* (or *sená*), used as a name for various plants, the leaves of which were known to have purgative properties, all now probably included in *Cassia.* In current parlance, senna is applied vernacularly to the herbaceous Cassias, especially to those falling in the subgenus *Senna.* The term has more specific use in pharmacology, being applied to the drug derived from dried leaves of *Cassia obovata* Collad. (= *C. senna* L.), *C. angustifolia* Vahl, and *C. acutifolia.*

Linnaeus (1753) enumerated 30 species, 4 of which have since been reduced to synonymy. From his time to the early years of the 19th century many new species were added, mainly from the New World. The first truly critical study of the genus had been by Breyne (1689), who proposed the infrageneric entities *Fistula, Chamaecassia,* and *Chamaecrista,* and distinguished these taxa on the basis of the position of the seed in the pod. Persoon (1805) proposed a considerably narrower delimitation of *Cassia,* removing *C. fistula* L. and its then known allies into the genus *Cathartocarpus* Pers. Willdenow (1813) added a few species to *Cassia* and changed Persons's *Cathartocarpus* to *Bactyrilobium* Willd. However, F. von Mueller later restored *Cathartocarpus.*

Miller (1754) adopted *Senna* as a generic name for the species of *Cassia* producing the commercially important purgative leaflets. *Senna* had been used in this sense previously by Matthiolus (1570), Dodonaeus (1583), Breyne (1689), and Tournefort (1797), and Miller was followed by Gaertner (1791), Roxburgh (1832) and Batka (1866).

Resumption of wide generic delimitation of *Cassia,* suggested by de Candolle, was made by Colladon (1816) and adopted, after considerable amplification by addition of many species, by de Candolle in his Prodromus (1825).

Because of the great number of new species he found among Sellow's Brazilian collections, Vogel (1837) was impelled to revise the genus again. This he did with discrimination, suppressing a number of previously described taxa, and enumerating some 278 species in all. The most outstanding, and as has been mentioned, most recent general revision of *Cassia* was by Bentham (1871). The infrageneric organization proposed by Bentham, still widely followed, is given in Table I.

TABLE I

Major Infrageneric Organization of *Cassia* according to Bentham (1871)

Subgenus and section Fistula. Trees. Stamens 10, usually all functional, the 3 inferior with long arcuate filaments, anthers with basal pores. Pod elongate, woody, terete or nearly so, indehiscent. Seeds horizontal, transverse. Species: 10 + 5.[a] Distribution: tropics.

Subgenus Senna. Trees, shrubs, and herbs. Functional stamens 7 or 10, anthers with 1–2 apical pores or less commonly with short slits. Pod terete or compressed, dehiscent by one or both sutures, the valves inelastic, or indehiscent.

Section Chamaefistula. 7 anthers functional, 3 staminodial. Pod turgid, terete or slightly compressed. Seeds. transverse or oblique. Glands between 1 or pairs of leaflets, or absent. Species: 44 + ca. 30. Distribution: mostly tropical America, a few spp. in Africa.

Series Bacillares. Leaflets bijugate, broad. Gland between lower pair, rarely both. Pod indehiscent.

Series Corymbosae. Leaflets 3-plurijugate. Gland between lowest or more pairs. 2 or 3 stamens with elongate filaments. Pod straight or slightly incurved, indehiscent or tardily dehiscent.

Series Excelsae. Leaflets multijugate. Gland none. Perfect anthers very obtuse. Pod elongate, subcylindrical, hard, indehiscent or tardily dehiscent.

Series Brachycarpae. Leaflets 1-plurijugate. Gland between 1 or more pairs. Functional stamens subequal or 2–3 lower with elongate filaments. Pod short, incurved or rarely straight, submembranous, usually dehiscent by an apical slit.

Section Oncolobium. Leaflets plurijugate. Gland 1, at base of petiole. Functional stamens 7, staminodes 3. Pod subcylindric to compressed. Seeds transverse or oblique.

Section Prososperma. Leaflets bi-plurijugate. Glands 1-few, between lowest or more pairs. Functional stamens 7, staminodes 3. Pod subterete or 4-angled or compressed-lomentose. Seeds longitudinal. Species 14 + 5. Distribution: tropics, mostly in America.

Series Torae. Peduncles short, 1–2-flowered. Pod inarticulate.

Series Confertae. Flowers in condensed axillary racemes, often conferted. Pod articulate.

Series Laxiflorae. Flowers in lax racemes.

Series Coriaceae. Flowers in panicles.

Section Chamaesenna. Leaflets mostly plurijugate, interglandular or eglandular. 7 stamens functional, 3 staminodial. Pod compressed, often plane. Seeds transverse or oblique, often flattened. Species: 74 + ca. 80. Distribution: tropics, and subtropical North and South America.

A. Glands between some or all pairs of leaflets.

Series Pachycarpae. Leaflets mostly paucijugate. Stipules linear-setaceous or caducous. Anthers erostrate, dehiscent by 1–2 apical pores. Pod short and broad to long and narrow, the convex margin often much broadened.

Series Aphyllae. Leaves much reduced or absent, the rush-like stems thickened and green. Peduncles 1-few at a node, often 2-flowered. Pod linear, flat, margined.

Series Rostratae. Leaflets pauci- or plurijugate, membranous. Stipulates linear-setaceous or caducous. 2 or 3 inferior anthers cylindric-rostrate, with terminal pores. Pod often narrow, the valves plane, with thickened margins.

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[a] The first figure is the number of species assigned by Bentham to this section; the second is the number of species since described which are referable here.

Species: 11 + 5. Distribution: tropical America, with 1–2 spp. pantropic.

Series Auriculatae. Leaflets pauci- or plurijugate. Stipules foliaceous. Anthers erostrate or nearly so. Pod broad, plane, margined.

B. Glands absent.

Series Floridae. Flowers in axillary racemes or terminal panicles. Pod often elongate, plane, with thickened margins.

Series Pictae. Flowers in bracteate strobiliform terminal or axillary racemes. Pod mostly plane or cristate over seeds, in one species longitudinally alate.

Series Brachycarpae. Flowers in elongating racemes, the buds enclosed in caducous bracts. Pod short, broad, arcuate or straight, much flattened or cristate over seeds.

Section Psilorhegma. Petiolar gland present or wanting. Stamens all functional. Pod as in section *Chamaesenna. Species* 20 + 1. Distribution: tropical and subtropical Australia, Southeast Asia, and islands of the Pacific.

Series Interglandulosae. Glands of rachis conspicuous, between lowest pair of leaflets or some or all pairs.

Series Subverrucosae. Glands of rachis small and obscure, or absent.

Subgenus Lasiorhegma. Trees, shrubs, and herbs. Functional anthers 10 or less, dehiscent by terminal slits or pores, rarely opening on sides, lateral sutures often villous. Pod elastically bivalvate. Funicles very short.

Section Apoucouita. Racemes short, borne on previous year's or older wood. Species: 3 + 3. Distribution: tropical South America.

Section Absus. Racemes or panicles terminal, or racemes also in upper axils, often viscous. Species 73 + ca. 30. Distribution: tropical America, 1 sp. more or less pantropic.

Series Absoideae. Leaflets bijugate, membranous. Petioles eglandular (except in *C. absus*)

Series Unijugae. Leaflets unijugate, rigidly membranous or coriaceous. Petioles eglandular.

Series Baseophyllae. Leaflets 1—8-jugate, coriaceous. Racemes often short.

Series Paniculatae. Leaflets 2- or rarely 3-jugate, coriaceous, often broad. Petiole eglandular. Racemes in large lax leafless panicles.

Series Rigidulae. Leaflets 2—8-jugate, very rarely 8—10-jugate, coriaceous, mostly glabrous. Petiole eglandular. Racemes simple or abbreviate.

Series Microphyllae. Leaflets 6-multijugate, small, pubescent or setose. Petiole eglandular.

Series Nigricantes. Leaflets 2—12-jugate, viscous, pubescent or villous; petiole eglandular.

Section Chamaecrista. Pedicels solitary or subfasciculate on a very short peduncle, axillary or supra-axillary. Species: 79 + ca. 190. Distribution: pantropic, and extending into cooler latitudes of North and South America.

Subsection Xerocalyx. Sepals rigid, subscarious, striately multinerved.

Subsection Leiocalyx. Sepals membranous, never striate.

Series Subaphyllae. Stipules cordate, appressed to stem. Leaves restricted to base of stem.

Series Prostratae. Prostrate annual or basally perennial herbs, often patently pilose. Leaflets 1-plurijugate, membranous. Gland on straight stipe, or sessile. Flowers small to moderate, the pedicels filiform.

Series Coriaceae. Shrubs and subshrubs, rarely perennial herbs. Leaflets coriaceous, rigid or rather thick, 2-many-nerved from base, costa subcentral or eccentric, penninerved. Gland depressed, scutellate or urceolate, sessile or stipitate.

Series Subcoriaceae. Erect perennial herbs or shrubs. Leaflets 3—10-jugate, obtuse, often subcoriaceous, costa subcentral and penninerved. Gland sessile, rarely stipitate.

Series Chamaecristae verae. Herbs or suffrutices. Leaflets 8—20-jugate (often more than 30-jugate in *C. mimosoides*), membranous, costa subcentral or eccentric, penninerved or the lateral veins rarely obscure. Gland sessile or stipitate.

Series Dimidiatae. Suffrutices or procumbent herbs, rarely erect shrubs. Leaflets 8—20-jugate, rarely 20—30-jugate, narrow, often rigidly acute, costa approaching the superior margin or confluent with it, exterior venation often oblique.

With regard to the section *Chamaecrista,* Linnaeus (1753) included 5 species of *Cassia* under the heading, "Chamaecristae foliolis numerosis." Moench (1794) elevated *Chamaecrista* to generic rank, distinguishing it by the occurrence of 5 fertile stamens as against 7 in *Cassia.* Schrank (1805, 1808), in proposing his new genus *Grimaldia,* extracted *C. nictitans* L. from *Chamaecrista,* and *C. absus* L. from the Linneaean section *Sennae.* In his revision of *Cassia,* Colladon (1816) distinguished the sections *Absus* and *Chamaecrista* from the rest of the genus by their acuminate calyces and bibracteolate pedicels. Section *Absus* was characterized by villous anthers dehiscing by longitudinal slits; *Chamaecrista* by glabrous biporous anthers. De Candolle, following Colladon, described 6 species under section *Absus,* 80 under *Chamaecrista.* Kunth (1824) maintained *Chamaecrista* as a section, characterizing it by pinnate leaves of one to many pairs of leaflets, usually with glandular petioles, and by solitary flowers on axillary or supra-axillary, bibracteolate peduncles. Both sections were included in the genus *Chamaecrista* Moench by Meyer (1835).

Vogel (1837) combined de Candolle's sections *Absus, Baseophyllum,* and *Chamaecrista* in a new section of *Cassia, Lasiorhegma* Vogel, which was characterized by anthers with 2 villous clefts, dehiscent through part of their length, and by a compressed elastically dehiscent pod. As is shown in Table I, Bentham recognized three subgenera in *Cassia,* the subgenus *Lasiorhegma* being divided into three sections, mainly on the basis of inflorescence. One of these sections, *Chamaecrista,* was described as consisting of shrubs and herbs with axillary or supra-axillary peduncles, each bearing one to four flowers.

Bentham divided the section *Chamaecrista* into 2 subsections. The first, and the object of concern here, he called *Xerocalyx,*[2] characterized as having "sepala rigidula, subscariosa, tenuiter striato-multinervia." To this subsection he assigned 12 species and 3 varieties, all from tropical America. The remaining species of the section *Chamaecrista* were placed in the subsection *Leiocalyx* which was described as having "sepala membranacea, haud striata." Although many new species of *Cassia* have been discovered in the 90 years since the publication of Bentham's revision, it stands as a testimony to the fundamental soundness of his treatment that nearly all new material can readily be assigned to infra-generic categories recognized by him.

As has been mentioned, all treatments of the genus since Bentham's have dealt with particular infra-generic groupings or with regional representation. Such limited approaches, while understandable as regards practicality, have led to considerable confusion, particularly in the sections *Xerocalyx* and *Chamaecrista.* This had begun with Rafinesque's (1838) fragmentation of *Cassia* into 21 genera, most of which were distinguished by single characters. Of the total, 7 were derived from the section *Chamaecrista* (sensu Benth.). Greene (1897), in observing the asymmetry of the corolla and rotated position of the flower in *C. fasciculata* Michx. (= *C. chamaecrista* L.) as compared with the dorsiventrality of zygomorphy in flowers of *C. marilandica* L. advanced the opinion that *Chamaecrista* had strong claim to generic rank. He placed 32 species in the resurrected genus (1897, 1899), among which were *Chamaecrista diphylla* (L.) Greene and *Ch. brevipes* (DC.) Greene. This view was upheld by Pollard (1902), Small (1903), and Pennell (1917), each of whom added several species. Britton and Rose (1930) recognized 111 species in *Chamaecrista,* and divided the genus into 17 sections. The first 2 of these sections, both derived from the Benthamian subsection *Xerocalyx,* were section *Diphyllae,* characterized by one pair of leaflets and containing only *Ch. diphylla,* and section *Uniflorae,* with two pairs of leaflets and containing two species, *Ch. brevipes* and *Ch. madrensis* Rose. Britton and Killip (1936) evidently combined the two sections under section *Uniflorae,* for *Ch. cultrifolia* (H.B.K.) Britt. & Rose, a unijugate species, was placed in that section together with 4 bijugate species.

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[2] Since it is to be proposed that this subsection be elevated to sectional status, any unqualified mention made hereafter of *Xerocalyx* will be intended at this level.

Notwithstanding the preference of some workers (e.g. Pittier et al., 1945) to retain *Chamaecrista* at the generic level, the tendency in recent years (e.g. León & Alain, 1951; Lemée, 1952), especially as the great mass of species of Brazil have become better known, has been to restore the delimitation of *Cassia* to the broadest sense and to suppress the sundry segregate genera of Rafinesque and Britton and Rose into synonymy. DeWit (1955), who followed Bentham, was of the opinion that so long as the general morphological pattern of *Cassia* is admitted to serve as a stratum on which many species groups represent parallel segregations or homologous series, it is "a matter of appreciation" whether 3 genera are recognized or a single genus is subdivided into 3 infrageneric taxa. The representation of *Cassia* in Asia, where the 3 subgenera are very distinct, tends to provide neater support for such a view than does the much greater variability exhibited in tropical America. It is clear that of a genus with such proportions and distribution, a comprehensive knowledge must be at hand before significant generalizations can be made. It is felt, therefore, that until good contrary evidence comes to light, the major infrageneric structure of Bentham, certainly the most natural and practical of those yet proposed, should be retained. Accordingly, in the present treatment, the dichotomous subdivision of the section *Chamaecrista* will be recognized, but evidence will be presented favoring the elevation of the subsection *Xerocalyx* to sectional rank.

In Martius's Flora Brasiliensis (1870), Bentham provides the following synopsis of the section *Chamaecrista* and its two component subsections:

Sectio VIII. CHAMAECRISTA

Herbae fruticesve glabri pubescentes v. pilosi, nee viscosi. Pedicelli solitarii v. in pedunculo communi vix evoluto 2–4-ni, axillares supraaxillares v. in mediis internodiis oriundi. Antherae saepe inaequales v. minores deficientes.

Sectio imprimis inflorescentia ab *Abso* distincta.

Subsectio 1. Xerocalyx.

Sepala rigidula subscariosa tenuiter crebreque striatomultinervia. Foliola in petiolo sessilia, subdimidiata, multinervia. Stipulae ovatae v. lanceolatae, cauli adpressae, rarius caducae. Pedicelli axillares, saepissime solitarii.

Subsectio 2. Leiocalyx.

Sepala membranacea, haud striata.

It is clear, then, that Bentham distinguished the subsections mainly on the basis of sepal characters, especially with regard to thickness and venation pattern. On the following pages a more detailed account of the differences observed between the section *Xerocalyx* and other members of the genus will be presented.

MORPHOLOGICAL AND ANATOMICAL STUDIES

1. *Petiolar Trace Patterns*

In the course of a broad yet detailed investigation of the vascular anatomy of the petiole and rachis of the Leguminosae, Watari (1934) included several species of *Cassia*. It had been stated by Acqua (1887) and reaffirmed by Sinnott (1914) that in the Leguminosae the leaf is nearly always supplied with three foliar traces, each emerging from a gap in the vascular cylinder of the stem. Such an arrangement was termed by the latter author the trilacunar gap. These observations were supported by Watari, but who, as a result of studying a large number of species, found numerous exceptions, i.e. in *Erythrophleum guineense* G. Don, *Caesalpinia sappan* L., *C. bonducella* Fleming, and *Schizolobium excelsum* Vog., all of the subfamily Caesalpinioideae and all with five or more foliar traces. Several species of the subfamily Papilionatae were also found to be multilacunar and a few species of the tribe Genisteae were observed to have a single trace. No exceptions to the prevailing trilacunar pattern were noted in the subfamily Mimosoideae.

Sinnott and Bailey (1915) state with strong affirmation that the most primitive type of vascular system in the petiole is that in which there are three foliar traces emerging from their own gaps and running separately through the entire course of the petiole. To date, the latter aspect of this pattern has not been reported in leaves of the Leguminosae. In all species examined by Watari, those with three or more foliar traces showed trace fusion at the base of the petiole, most commonly in the pulvinus. This is essentially confirmed in the species of *Cassia* examined in connection with the present investigation. Further, the bundles, while free or variously fused in the mid-portion of the petiole, tend to fuse quite completely in the rachis nodules.

Watari noted that in many genera of the Leguminosae, *Cassia* included, the slender mid-portion of the petiole, and frequently the rachis as well, are characterized by the presence of a pair of more or less distinct ridges between which is a usually well defined groove. In all species of *Cassia* examined by Watari and all but *C. reticulata* Willd. by the present author, distinct ridges were found, each containing one to three bundles. In the ridgeless *C. reticulata* the two pairs of bundles were grouped together beneath the rounded adaxial surface of the petiole. When long series of sections were cut distally from the petiolar base, ridge bundles were seen to arise from the basal vascular ring immediately distal to the pulvinus, i.e., at the slender basal portion of the petiole. Mode of departure was of two fairly distinct types. In *C. grandis* L.f., *C. javanica* L., and *C. ferruginea* Schrad., all in the subgenus and section *Fistula,* and in *C. reticulata* of the section *Chamaesenna,* series *Pictae,* the ridge bundles arose from the center of the adaxial surface of the basal vascular ring in a manner observed by Watari to be quite general in the Papilionoideae. In the three former species the bundles rapidly diverged, with a broad groove developing between; in *C. reticulata* they remained closely parallel. The remainder of the species examined showed a departure pattern quite similar to that noted by Watari as general in the Mimosoideae, i.e. from widely separated portions of the adaxial side of the basal vascular ring. Between these two points of departure there remains in some cases a vascular segment, often quite large, which is a portion of the main bundle, and which, in many cases, divides as the narrow region of the petiole is approached.

In the present investigation, slides were prepared according to agar method described by Watari. However, owing to the marked contrast of bundle structure with the cortical parenchyma, it was found that staining was unnecessary. In all cases serial sections were cut free-hand in elder pith from the distal end of the pulvinus to the first nodule. Sections were examined under the microscope and from each series a camera-lucida drawing was made of that section which showed the most distinct vascular pattern, i.e. least like the ring-like pattern of the pulvinus and the first internodule. In all cases the region exhibiting this distinctness was approximately half way between the pulvinus and the first nodule.

It was the purpose of this study to establish the vascular pattern in petioles of the *Xerocalyx* species and to compare this with the patterns evident elsewhere in the genus. Accordingly, all taxa assignable to *Xerocalyx* were studied, and then compared with three or more representatives from each of the remaining major infrageneric taxa of *Cassia*. Each species studied was represented by 3–5 collections which, when possible, were from distant regions. In Figs. 1–62 the mid-petiolar patterns of all studied species are reproduced.

It is clear from Figs. 1–30 that in *Xerocalyx* the vascular pattern is quite uniform. The vascular elements of the petiole proper are in most instances wholly or nearly ensheathed in collenchyma. There are three usually distinct petiolar bundles and always one pair of strongly developed ridge bundles, each placed well up in its respective ridge. Between the ridges is a pronounced groove. Deviation from the general *Xerocalyx* pattern is most marked in *C. calycioides* DC., considered by Bentham as belonging to his subsection *Xerocalyx,* and the closely related *C. aristellata* Cory & Parks, both of which species, on this and additional bases, seem best excluded from the proposed section *Xerocalyx*.

The following general observations may be made with respect to the pattern contrast between species of *Xerocalyx* and the other species of *Cassia* examined. In

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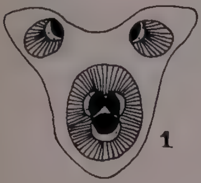
Figs. 1–15. Mid-petiolar cross sections of *Cassia* spp. in section *Xerocalyx,* × 20. Solid black: xylem; dotted: phloem; lined: collenchyma. Fig. 1. *C. cultrifolia.* Fig. 2. *C. diphylla.* Fig. 3. *C. latistipula.* Fig. 4. *C. gracilis.* Fig. 5. *C. piribebuiensis.* Fig. 6. *piauhiensis.* Fig. 7. *C. langsdorffii* var. *latifoliola.* Fig. 8. *C. langsdorffii* var. *langsdorffii.* Fig. 9. *C. langsdorffii* var. *parvifoliola.* Fig. 10. *C. langsdorffii* var. *tenuis.* Fig. 11. *C. curvifolia* var. *mollissima.* Fig. 12. *C. curvifolia* var. *lucida.* Fig. 13. *C. curvifolia* var. *curvifolia.* Fig. 14. *C. ramosa* var. *ramosa.* Fig. 15. *C. ramosa* var. *littoralis.*

Figs. 16–30. Mid-petiolar cross sections of *Cassia* spp. in section *Xerocalyx,* × 20. Solid black: xylem; dotted: phloem; lined: collenchyma. Fig. 16. *C. chartacea* var. *chartacea.* Fig. 17. *C. chartacea* var. *tenuicaulis.* Fig. 18. *C. malacophylla.* Fig. 19. *C. tecta.* Fig. 20. *C. saxatalis.* Fig. 21. *C. bartlettii.* Fig. 22. *C. madrensis.* Fig. 23. *C. tetraphylla* var. *linearis.* Fig. 24. *C. tetraphylla* var. *ventuarensis.* Fig. 25. *C. tetraphylla* var. *aurivilla.* Fig. 26. *C. tetraphylla* var. *brevipes.* Fig. 27. *C. tetraphylla* var. *mollissima.* Fig. 28. *C. tetraphylla* var. *tetraphylla.* Fig. 29. *C. tetraphylla* var. *littoralis.* Fig. 30. *C. tetraphylla* var. *colombiana.*

Figs. 31–45. Mid-petiolar cross sections of *Cassia* spp. in sections *Fistula* (Figs. 31–33), *Chamaefistula* (Figs. 34–36), *Oncolobium* (Figs. 37–39), *Prososperma* (Figs. 40–42), *Chamaesenna* (Figs. 43–45), all × 20 except where otherwise noted. Fig. 31. *C. grandis* L. f., × 12. Fig. 32. *C. ferruginea* Schrad. Fig. 33. *C. javanica* L., × 12. Fig. 34. *C. splendida* Vog. Fig. 35. *C. bicapsularis* L. Fig. 36. *C. lindheimeriana* Scheele. Fig. 37. *C. occidentalis* L., × 15. Fig. 38. *C. sophera* L., × 15. Fig. 39. *C. marilandica* L., × 12. Fig. 40. *C. obtusifolia* L. Fig. 41. *C. pilifera* Vog. Fig. 42. *C. appendiculata* Vog. Fig. 43. *C. biflora* L. Fig. 44. *C. reticulata* Willd., × 8. Fig. 45. *C. pleurocarpa* F. Muell.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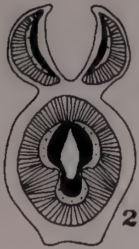
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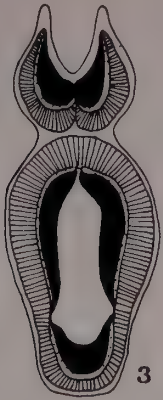
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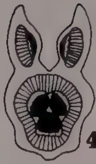
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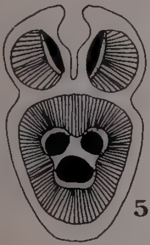
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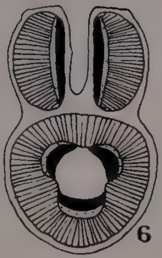
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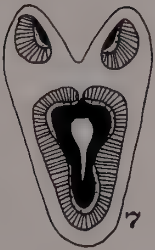
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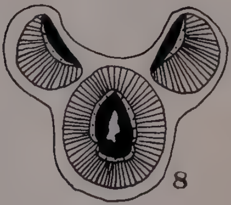
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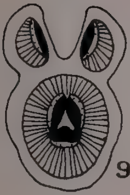
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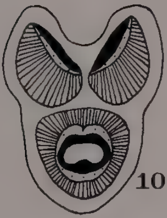
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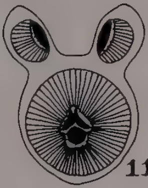
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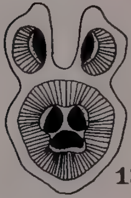
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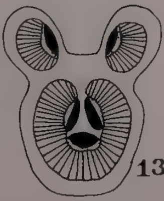
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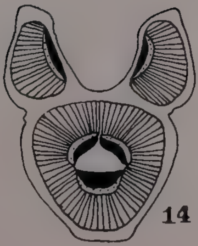
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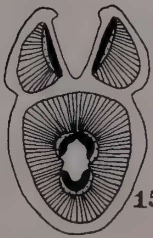
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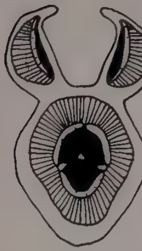

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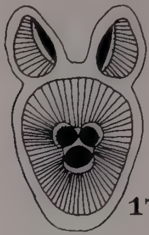

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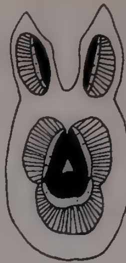

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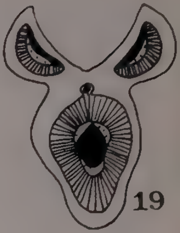

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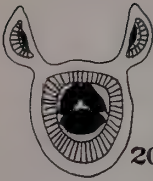

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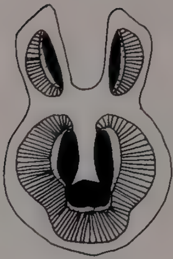

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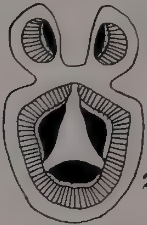

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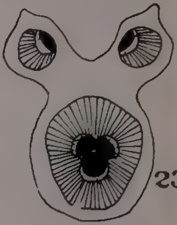

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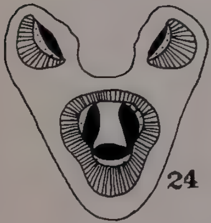

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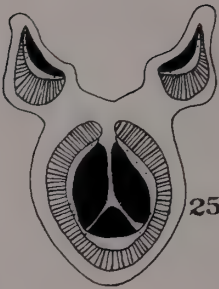

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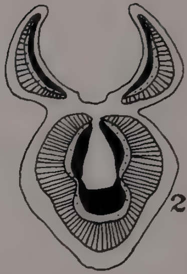

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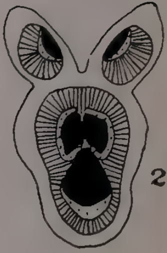

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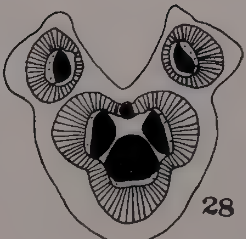

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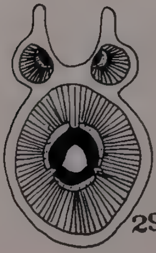

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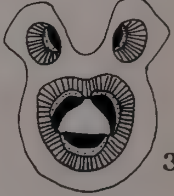

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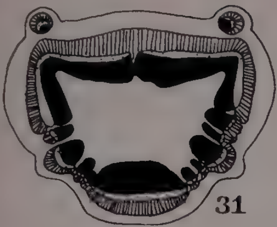
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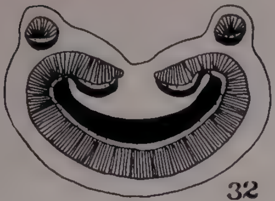
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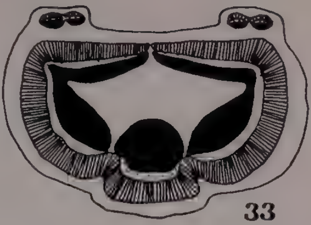
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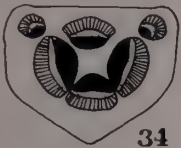
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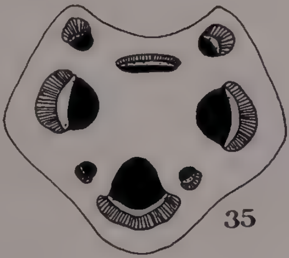
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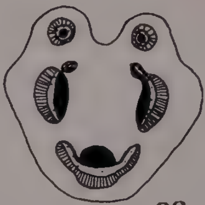
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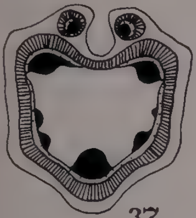
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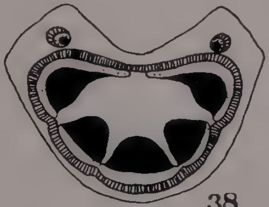
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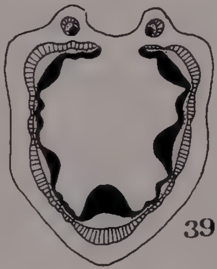
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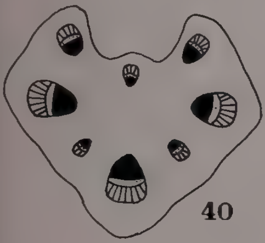
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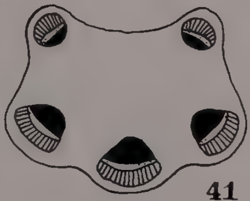
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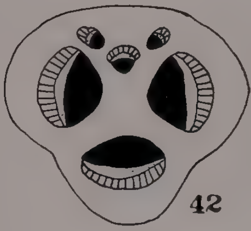
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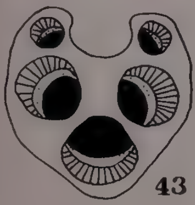
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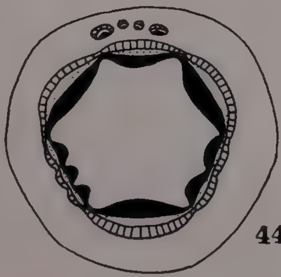
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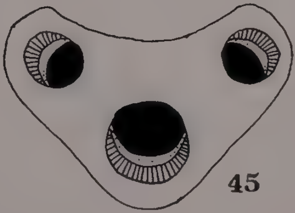
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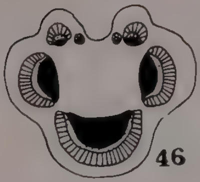
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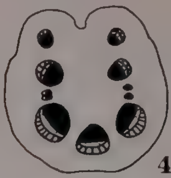
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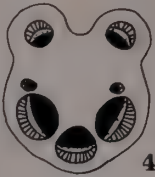
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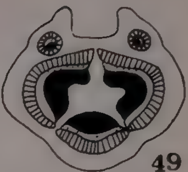
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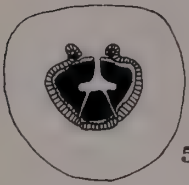
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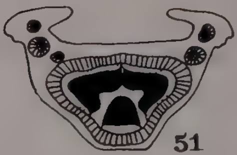
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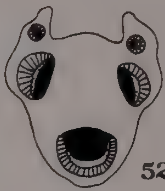
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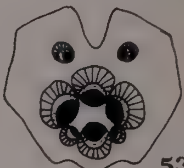
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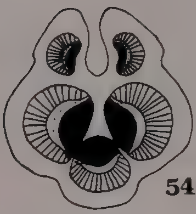
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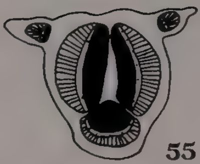
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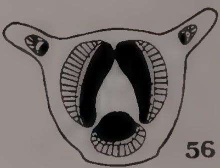
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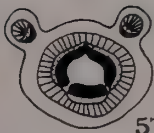
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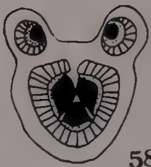
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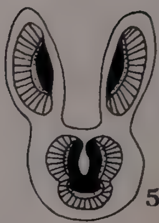
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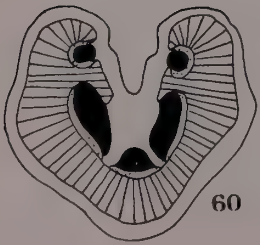
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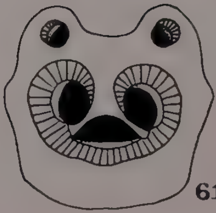
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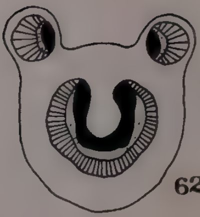
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most species of *Xerocalyx,* all of which have petioles 1.5 cm or less in length, the cross-sectional area of collenchyma is far higher than that of vascular tissue. The vascular portion of the ridge bundles in *Xerocalyx* tends to lie toward the adaxial side of the bundle. The three bundles in the petiole proper are in close proximity, the collenchyma sheath describing a circle or oval around them.

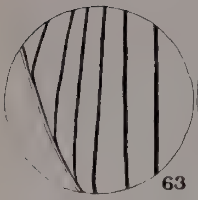
In the remainder of the genus, continuous collenchyma appears in the previously mentioned species of the subgenus and section *Fistula,* Figs. 31–33, in *C. occidentalis* L., *C. sophera* L., and *C. marilandica* L. of the subgenus *Senna,* section *Oncolobium,* Figs. 37–39, in *C. reticulata* Willd., Fig. 44, in *C. scleroxylon* Ducke and possibly *C. adiantifolia* Benth. of subgenus *Lasiorhegma,* section *Apoucouita,* Figs. 50 and 51, and in all members of the section *Chamaecrista* examined, Figs. 57–62. Location of the vascular elements in the ridge bundles of non-*Xerocalyx* species is very variable, but in the main is concentrated on the abaxial side. Exceptions are restricted to *C. rotundifolia* Pers., *C. serpens* L., and *C. leptadenia* Greenm. of section *Chamaecrista,* Figs. 58, 59, and 62, and to *C. scleroxylon* of section *Apoucouita,* Fig. 51. Close proximity of three distinct bundles of the petiole proper is seen rather uniformly in sections *Chamaecrista,* Figs. 57–62, and *Apoucouita,* Figs. 49–51, in *C. cathartica* Mart. of section *Absus,* Figs. 49–51, and in lesser degree elsewhere. Enclosure of the three closely placed main bundles by a ring or arc of collenchyma occurs in all members of section *Chamaecrista* examined, Figs. 57–62, and in *C. scleroxylon* and *C. adiantifolia* of section *Apoucouita,* Figs. 50 and 51.

Thus it may be concluded that while the vascular pattern of the mid-petiole in species of section *Xerocalyx* shows marked homogeneity, the various features of this pattern occur elsewhere in *Cassia,* especially in sections *Chamaecrista* and *Apoucouita.*

2. *Major Leaf Venation*

It is generally known that while the basic pattern of parallel venation in the Monocotyledonae is subject to considerable exception, e.g. *Smilax, Anthurium, Pothos, Calla, Symplocarpus,* etc., deviation from the reticulate pattern characteristic of the Dicotyledonae is uncommon. Parallel disposition of major veins is well established in certain Australian Myrtaceae (e.g. *Leptospermum*), in Plantaginaceae, and in the majority of genera of the Melastomaceae. In the *Xerocalyx* species the main veins, after initial divergence, become quite parallel or only slightly divergent for the remainder of their extent. Anastomoses are few, restricted for the most part to the marginal region.

FIGS. 46–62. Mid-petiolar cross sections of *Cassia* spp. in sections *Psilorhegma* (FIGS. 46–48), *Apoucouita* (FIGS. 49–51), *Absus* (FIG. 52–54), *Chamaecrista* (FIGS. 55–62), × 20 except where otherwise noted. FIG. 46. *C. gaudichaudii* Hook. & Arn. FIG. 47. *C. eremophila* Cunn. FIG. 48. *C. desolata* F. Muell. var. *involucrata* F. M. Black. FIG. 49. *C. apoucouita* Aubl., × 12. FIG. 50. *C. adiantifolia* Benth. FIG. 51. *C. scleroxylon* Ducke. FIG. 52. *C. absus* L. FIG. 53. *C. hedysaroides* Vog. FIG. 54. *C. cathartica* Mart. FIG. 55. *C. calycioides* DC. FIG. 56. *C. aristellata* Cory & Parks. FIG. 57. *C. basifolia* Vog. FIG. 58. *C. rotundifolia* Pers. FIG. 59. *C. serpens* L. FIG. 60. *C. choriophylla* Vog. FIG. 61. *C. mimosoides* L. var. *mimosoides.* FIG. 62. *C. leptadenia* Greenm.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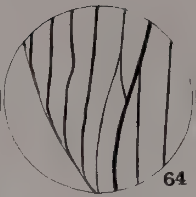
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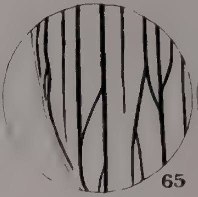
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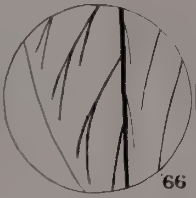
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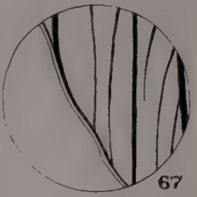
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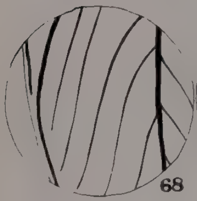
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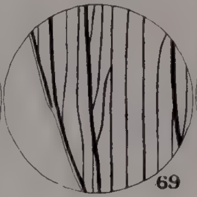
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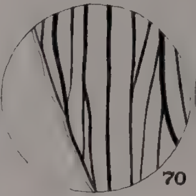
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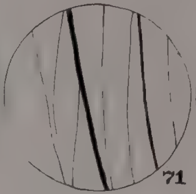
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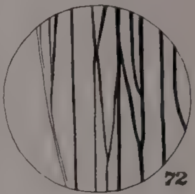
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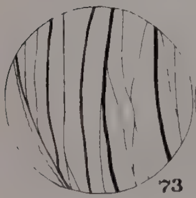
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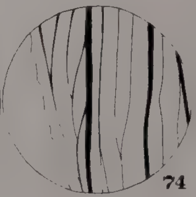
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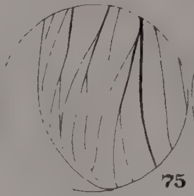
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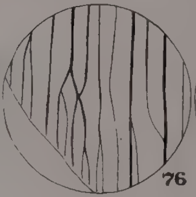
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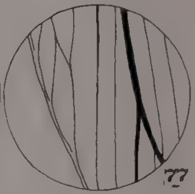
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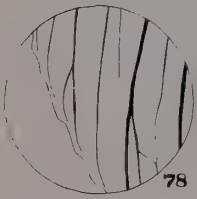
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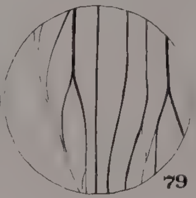
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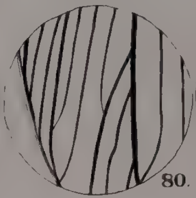
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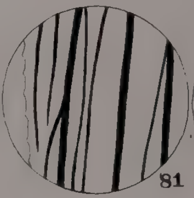
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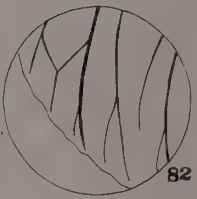
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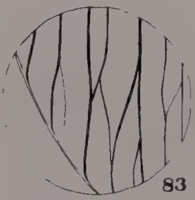
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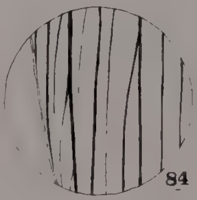
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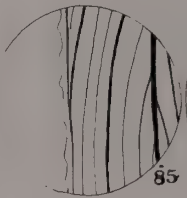
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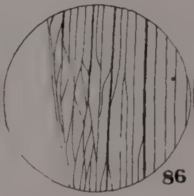
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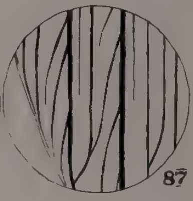
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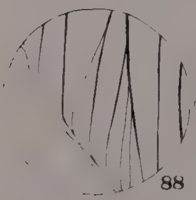
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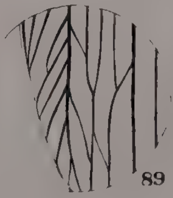
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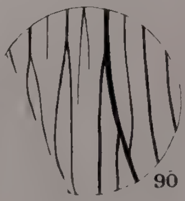
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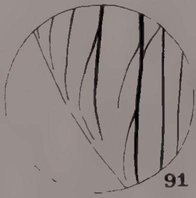
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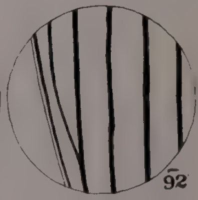
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To the knowledge of the present author, no comprehensive survey of laminal venation pattern has been published. Numerous detailed studies of vein islets, e.g. Benedict (1915), Strain (1933), Wylie (1939, 1946), have been made, wherein the patterns have been variously related to senescence, light exposure, and mesophyll organization, but the rationale underlying these investigations has been functional rather than phyletic.

As in the previous study, a survey was made of the genus. Each taxon assignable to the section *Xerocalyx* was examined, and the emergent pattern was then compared with those evident in representatives from other infrageneric groups. In each case the right hand member of the lowest pair of leaflets of a mature, fully expanded leaf was removed, decolorized in chloral hydrate, and mounted in glycerin. Slides were examined under low power and for each species a drawing was made of a field which included the outer margin of the leaflet at a position approximately one-third of the distance basipetal to the apex. Drawings thus made are reproduced in Figs. 63–116.

In all species examined except those of the section *Xerocalyx* and *C. calycioides* DC. and *C. aristellata* Cory & Parks, there is characteristically a well developed midrib. In some species of section *Chamaecrista* the midrib is known to be quite eccentic, e.g. in *Chamaecrista enneryana* Britt., *Cassia pinoi* (Britt. & Rose) Lundell, and *Chamaecrista mazatlensis* Rose, and in others nearly marginal, e.g. *Cassia strigillosa* Benth., *C. buchii* Urb., and *Chamaecrista haitiensis* Britt. In a few species of the section *Psilorhegma*, particularly *Cassia artemisioides* Gaudich. and *C. eremophila* Cunn., the laminal area is so reduced and pubescence so copious that the midrib is not externally apparent. However, cross sections through the leaflets of these species clearly establish not only its presence but also its very dominant role in the vascularization of such leaflets.

It is also readily apparent that in all material examined, again excepting that of section *Xerocalyx, C. calycioides,* and *C. aristellata,* vein branching patterns are basically of the pinnate type, and anastomoses of secondary, tertiary, and lower order veins are of general occurrence. By contrast the venation pattern in *Xerocalyx* is quite distinct and can be so determined microscopically. At the basal end of a leaflet blade, i.e. in the pulvinule, is seen an immediate branching of the trace into a fan-like divergence of several to many veins. In species with narrow leaflets these veins soon become straight and parallel, and remain so until the margin of the apical half is approached. In most species there can be seen under the microscope

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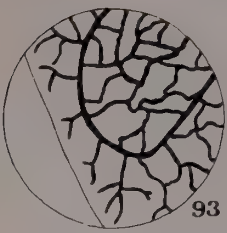
FIGS. 63–92. Venation patterns in leaflets of *Cassia* spp. in section *Xerocalyx*, × 40. FIG. 63. *C. cultrifolia*. FIG. 64. *C. diphylla*. FIG. 65. *C. latistipula*. FIG. 66. *C. gracilis*. FIG. 67. *C. piribebuiensis*. FIG. 68. *C. piauhiensis*. FIG. 69. *C. langsdorffii* var. *latifoliola*. FIG. 70. *C. langsdorffii* var. *langsdorffii*. FIG. 71. *C. langsdorffii* var. *tenuis*. FIG. 72. *C. langsdorffii* var. *parvifoliola*. FIG. 73. *C. curvifolia* var. *mollissima*. FIG. 74. *C. curvifolia* var. *lucida*. FIG. 75. *C. curvifolia* var. *curvifolia*. FIG. 76. *C. ramosa* var. *ramosa*. FIG. 77. *C. ramosa* var. *littoralis*. FIG. 78. *C. chartacea* var. *chartacea*. FIG. 79. *C. chartacea* var. *tenuicaulis*. FIG. 80. *C. malacophylla*. FIG. 81. *C. tecta*. FIG. 82. *C. saxatilis*. FIG. 83. *C. bartlettii*. FIG. 84. *C. madrensis*. FIG. 85. *C. tetraphylla* var. *linearis*. FIG. 86. *C. tetraphylla* var. *ventuarensis*. FIG. 87. *C. tetraphylla* var. *aurivilla*. FIG. 88. *C. tetraphlla* var. *brevipes*. FIG. 89. *C. tetraphylla* var. *mollissima*. FIG. 90. *C. tetraphylla* var. *tetraphylla*. FIG. 91. *C. tetraphylla* var. *littoralis*. FIG. 92. *C. tetraphylla* var. *colombiana*.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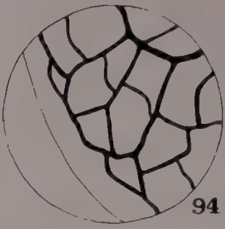
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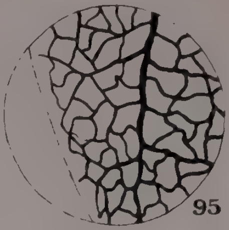
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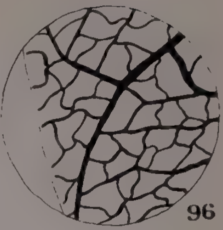
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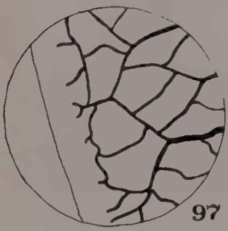
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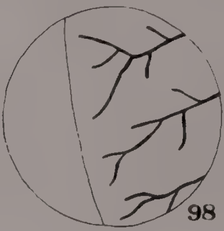
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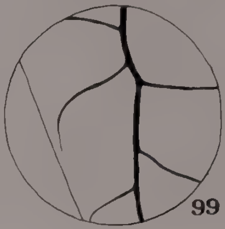
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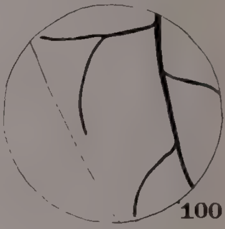
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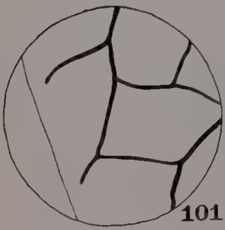
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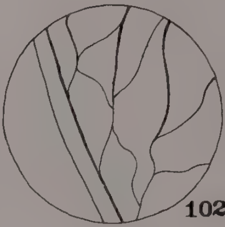
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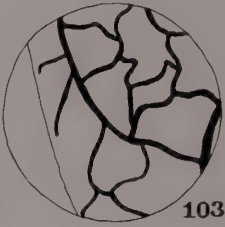
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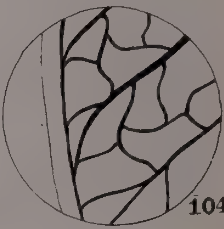
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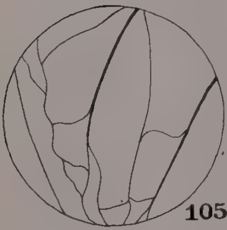
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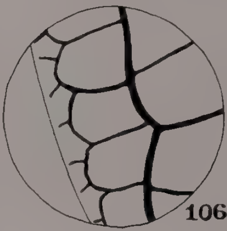
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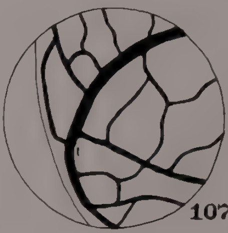
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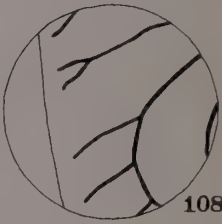
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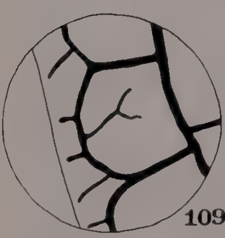
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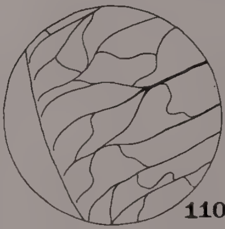
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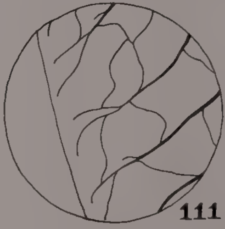
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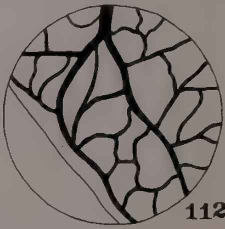
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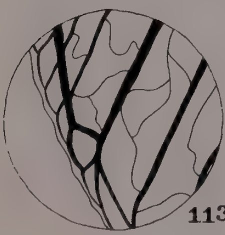
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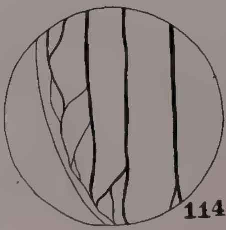
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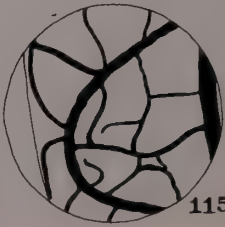
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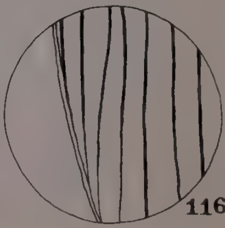
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some narrow-angled anastomosis in the marginal region. In the peripheral millimeter around the apical half of the leaflet the veins may terminate before reaching the margin, or turn and continue a short distance parallel to the margin before terminating, or anastomose with the next inner vein as it approaches the margin and thus form a marginal vein. In the few stained preparations which were made, interconnections among veins were observed to be effected rather generally by very diminutive veinlets, in the manner well known for grasses. These veinlets could not be seen in the unstained preparations.

As a summary, it may be said that the venation of leaflets in section *Xerocalyx* and in *C. calycioides* and *C. aristellata* is distinct from the observed elsewhere in *Cassia* by (1) absence of a midrib; (2) division of the vascular bundle at the base of the leaflet into numerous more or less equal veins which initially diverge and then follow a quite or nearly parallel course to the apical margin; (3) limited narrow-angled anastomoses near the margin; (4) apparent lack of anastomoses elsewhere except when high-contrast staining techniques are employed.

3. *Calyx Venation*

As has been mentioned, Bentham (1871) established the subsection *Xerocalyx* on the basis of venation and firmness of the sepals. However, since a number of the taxa included here in the section *Xerocalyx* were not known to him, the present author felt a survey of calycular venation in *Cassia* was needed.

Treatment of sepals was essentially the same as that of leaflets. Several sepals, one each from several specimens of each taxon, were removed,[3] decolorized in chloral hydrate, mounted in glycerin, and examined microscopically. Drawings were prepared from the right hand margin of the upper (inner) surface, approximately one-third of the distance basipetal from the apex. These drawings are reproduced in Figs. 117–172.

Even more clearly than in the leaflets, it is seen that *Xerocalyx* is distinctive in the pattern of sepal venation. The veins are invariably parallel to the long axis of the sepal, and in some species anastomose at the margin, resulting in the formation of a marginal vein. There appears to be no correlation between the type of vein termination in leaflets and in sepals. For example, *C. tetraphylla* Desv. var. *mollissima* (Benth.) Irwin has well developed marginal veins in the leaflets, but sepalar

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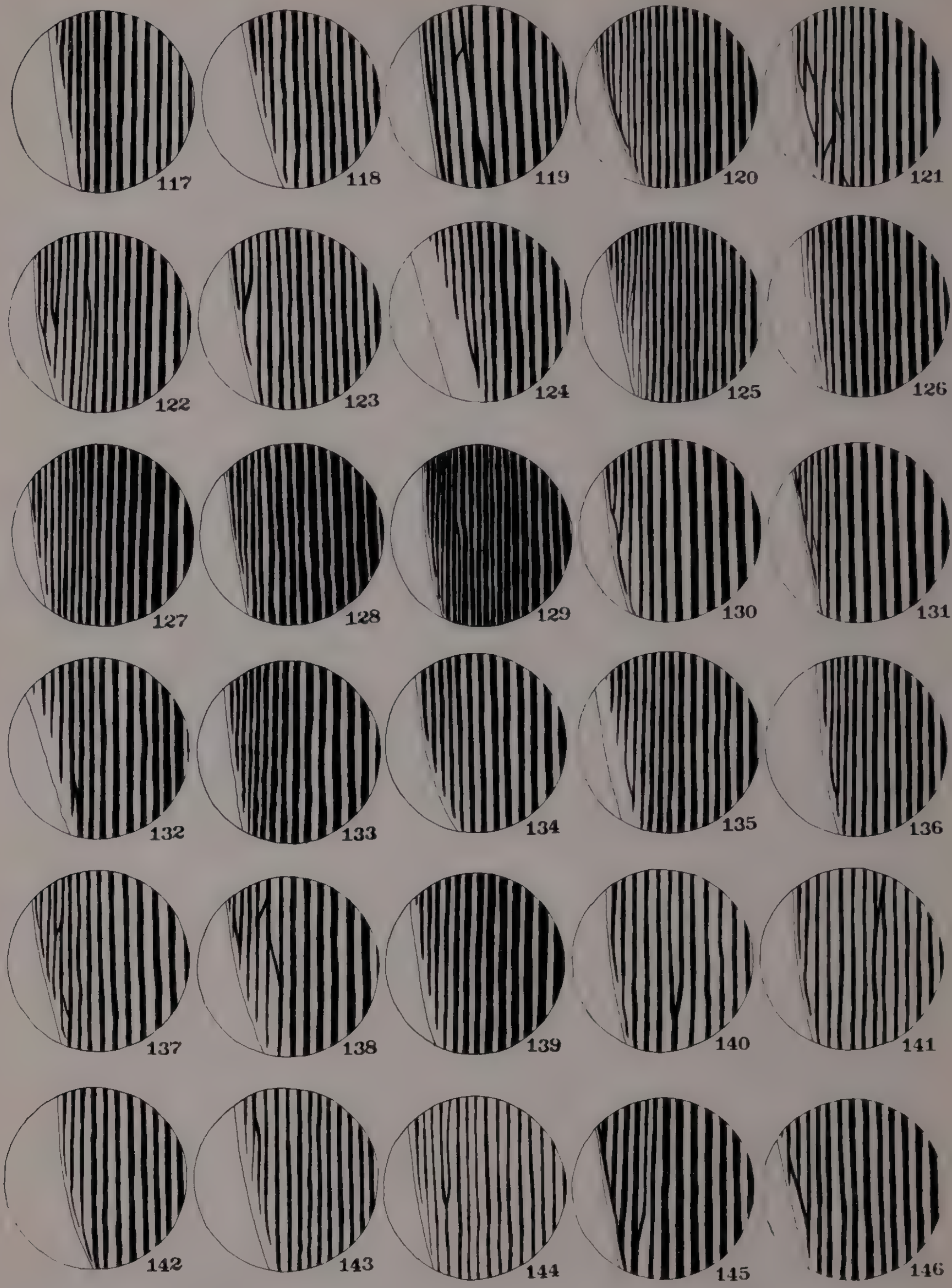
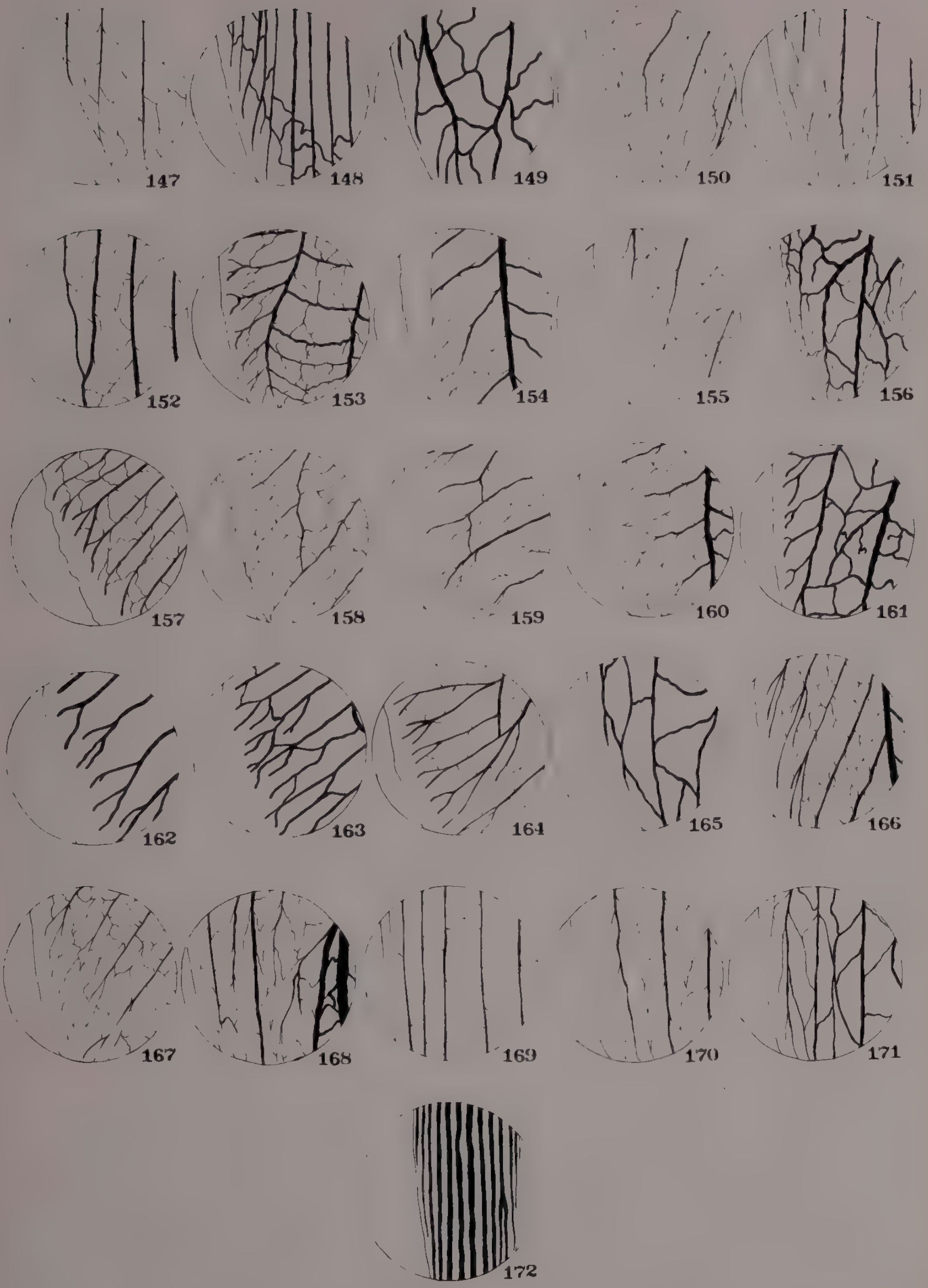
[3] In section *Xerocalyx*, where sepals are of unequal size, the largest was used.

FIGS. 93–116. Venation patterns in leaflets of *Cassia* spp. in sections *Fistula* (FIGS. 93–95), *Chamaefistula* (FIGS. 96–98), *Oncolobium* (FIGS. 99–101), *Prososperma* (FIGS. 102–104), *Chamaesenna* (FIGS. 105–107), *Psilorhegma* (FIG. 108), *Apoucouita* (FIG. 109), *Absus* (FIGS. 110–112), *Chamaecrista* (FIGS. 113–116), × 40. FIG. 93. *C. grandis* L. f. FIG. 94. *C. ferruginea* Schrad. FIG. 95. *C. javanica* L. FIG. 96. *C. splendida* Vog. FIG. 97. *C. bicapsularis* L. FIG. 98. *C bauhinioides* Gray. FIG. 99. C. *gooddingii* A. Nels. FIG. 100. *C. occidentalis* L. FIG. 101. *C. marilandica* L. FIG. 102. *C. obtusifolia* L. FIG. 103. *C. pilifera* Vog. FIG. 104. *C. uniflora* Mill. FIG. 105. *C. aphylla* Cav. FIG. 106. *C. biflora* L. FIG. 107. *C. alata* L. FIG. 108. *C. gaudichaudii* Hook. & Arn. FIG. 109. *C. apoucouita* Aubl. FIG. 110. *C. debilis* Vog. FIG. 111. *C. cathartica* Mart. FIG. 112. *C. benthamiana* Harms. FIG. 113. *C. basifolia* Vog. FIG. 114. *C. cordistipula* Mart. FIG. 115. *C. greggii* Gray. FIG. 116. *C. calycioides* DC.



FIGS. 117–146. Venation patterns in sepals of *Cassia* spp. in section *Xerocalyx*, × 40. FIG. 117. *C. cultrifolia.* FIG. 118. *C. diphylla.* FIG. 119. *C. latistipula.* FIG. 120. *C. gracilis.* FIG. 121. *C. piribebuiensis.* FIG. 122. *C. piauhiensis.* FIG. 123. *C. langsdorffii* var. *latifoliola.* FIG. 124. *C. langsdorffii* var. *langsdorffii.* FIG. 125. *C. langsdorffii* var. *tenuis.* FIG. 126. *C. langsdorffii* var. *parvifoliola.* FIG. 127. *C. curvifolia* var. *mollissima.* FIG. 128. *C. curvifolia* var. *lucida.* FIG. 129. *C. curvifolia* var. *curvifolia.* FIG. 130. *C. ramosa* var. *ramosa.* FIG. 131. *C. ramosa* var. *littoralis.* FIG. 132. *C. chartacea* var. *chartacea* FIG. 133. *C. chartacea* var. *tenuicaulis.* FIG. 134. *C. malacophylla.* FIG. 135. *C. tecta.* FIG. 136. *C. saxatilis.* FIG. 137. *C. bartlettii.* FIG. 138. *C. madrensis.* FIG. 139. *C. tetraphylla* var. *linearis.* FIG. 140. *C. tetraphylla* var. *ventuarensis.* FIG. 141. *C. tetraphylla* var. *aurivilla.* FIG. 142. *C. tetraphylla* var. *brevipes.* FIG. 143. *C. tetraphylla* var. *mollissima.* FIG. 144. *C. tetraphylla* var. *tetraphylla.* FIG. 145. *C. tetraphylla* var. *littoralis.* FIG. 146. *C. tetraphylla* var. *colombiana.*



Figs. 147–172. Venation patterns in sepals of *Cassia* spp. in sections *Fistula* (Figs. 147–148), *Chamaefistula* (Figs 149–151), *Oncolobium* (Figs. 152–154), *Prososperma* (Figs. 155–157), *Chamaesenna* (Figs. 158–160), *Psilorhegma* (Figs. 161–163), *Apoucouita* (Fig. 164), *Absus* (Figs. 165–167), *Chamaecrista* (Figs. 168-172), × 40. Fig. 147. *C. grandis* L. f. Fig. 148. *C. ferruginea* Schrad. Fig. 149. *C. affinis* Benth. Fig. 150. *C. bicapsularis* L. Fig. 151. *C. laevigata* Willd. Fig. 152. *C. gooddingii* A. Nels. Fig. 153. *C. occidentalis* L. Fig. 154. *C. marilandica* L. Fig. 155. *C. obtusifolia* L. Fig. 156. *C. pilifera* Vog. Fig. 157, *C. uniflora* Mill. Fig. 158. *C. biflora* L. Fig. 159. *C. wislizenii* Gray. Fig. 160. *C. emarginata* L. Fig 161. *C. gaudichaudii* Hook. & Arn. Fig. 162. *C. eremophila* Cunn. Fig. 163. *C. sturtii* R. Br. Fig. 164. *C. apoucouita* Aubl. Fig. 165. *C. ochracea* Vog. Fig. 166. *nummulariaefolia* Benth. Fig. 167. *C. debilis* Vog. Fig. 168. *C. choriophylla* Vog. Fig. 169. *C. fasciculata* Michx. var. *fasciculata*. Fig. 170. *C. mimosoides* L. var. *africana* Steyaert. Fig. 171. *C. texana* Buckl. Fig. 172. *C. calycioides* DC.

veins terminate rather abruptly. In *C. tetraphylla* var. *littoralis* Irwin the situation is reversed. Elsewhere in *Cassia,* where leaflet and sepal comparisons can be made within species, the correlation between leaflet and sepal pattern is clear, but in general the sepal venation is more delicate and more completely anastomosed.

In addition to striate sepal venation, Bentham noted the relative rigidity of the sepals in *Xerocalyx*. However, this is merely a reflection of the unidirectional course of what is in fact a series of more or less equivalent vein-units, as contrasted with the omnidirectional branching of variable units elsewhere in the genus. Moreover, when viewed from a plane surface, the cleared non-vascularized area in *Xerocalyx* sepals is proportionately much less than is seen in the rest of *Cassia.*

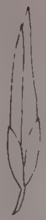
It should be noted that *C. calycioides* DC. and *C. aristellata,* Cory & Parks have sepal venation patterns essentially the same as those common to the section *Xerocalyx.*

Summarizing, the sepal venation of species in section *Xerocalyx* and in *C. calycioides* and *C. aristellata* is very distinctive, and appears as an augmented reflection of the leaflet venation pattern. Again, there is no single main vein, but rather a file of many nearly equivalent, little anastomosed, parallel veins, terminating or converging at the margin. Elsewhere in *Cassia,* sepal venation patterns vary, but are basically reticulate.

4. *Sepal Length*

It is readily apparent both from herbarium specimens and living plants that in the section *Xerocalyx* the sepals are unequal in length. This is in marked contrast to the near or complete dimensional equality among sepals in all other sections of the genus. Comparative sepal lengths in section *Xerocalyx* may be seen in Figs. 173–202, and in section *Chamaecrista* and *C. calycioides* and *C. aristellata* in Figs. 203–218. Degree of inequality among sepals in *Xerocalyx* varies considerably, but there are 3 length categories. The superior sepal is usually largest, followed and sometimes very nearly equalled by the 2 similar inferior ones. The remaining lateral members are always smaller and frequently quite alike. While this pattern is general throughout the section, the relative lengths are subject to much variation. The greatest disparity in length is seen in *C. curvifolia* Vog. and its varieties, where the smallest sepal is approximately one-half the length of the largest. In *C. tetraphylla* var. *littoralis,* on the other hand, the smallest is about three-fourths the length of the largest.

FIGS. 173–202. Floral buds of *Cassia* spp. in section *Xerocalyx,* × 1.8. FIG. 173. *C. cultrifolia.* FIG. 174. *C. diphylla.* FIG. 175. *C. latistipula.* FIG. 176. *C. gracilis.* FIG. 177. *C. piribebuiensis.* FIG. 178. *C. piauhiensis.* FIG. 179. *C. langsdorffii* var. *latifoliola.* FIG. 180. *C. langsdorffii* var. *langsdorffii.* FIG. 181. *C. langsdorffii* var. *tenuis.* FIG. 182. *C. langsdorffii* var. *parvifoliola.* FIG. 183. *C. curvifolia* var. *mollissima.* FIG. 184. *C. curvifolia* var. *lucida.* FIG. 185. *C. curvifolia* var. *curvifolia.* FIG. 186. *C. ramosa* var. *ramosa.* FIG. 187. *C. ramosa* var. *littoralis.* FIG. 188. *C. chartacea* var. *chartacea.* FIG. 189. *C. chartecea* var. *tenuicaulis.* FIG. 190. *C. malacophylla.* FIG. 191. *C. tecta.* FIG. 192. *C. saxatilis.* FIG. 193. *C. bartlettii.* FIG. 194. *C. madrensis.* FIG. 195. *C. tetraphylla* var. *linearis.* FIG. 196. *C. tetraphylla* var. *ventuarensis.* FIG. 197. *C. tetraphylla* var. *aurivilla.* FIG. 198. *C. tetraphylla* var. *brevipes.* FIG. 199. *C. tetraphylla* var. *mollissima.* FIG. 200. *C. tetraphylla* var. *tetraphylla.* FIG. 201. *C. tetraphylla* var. *littoralis.* FIG. 202. *C. tetraphylla* var. *colombiana.*



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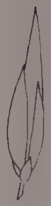

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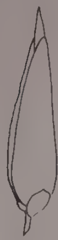

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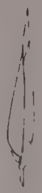

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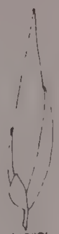

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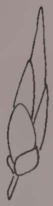

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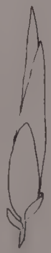

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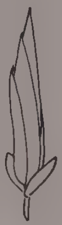

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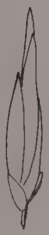

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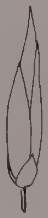

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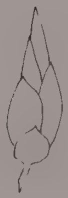

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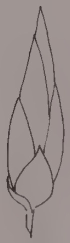

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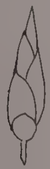

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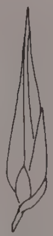

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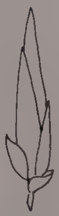

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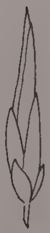

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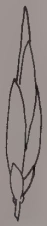

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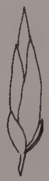

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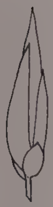

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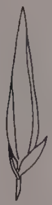

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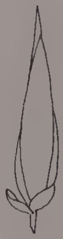

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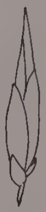

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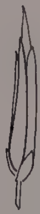

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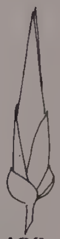

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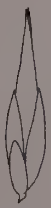

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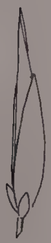

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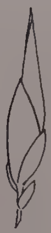

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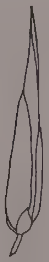

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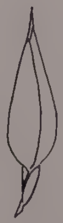

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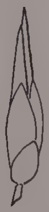

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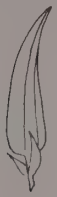
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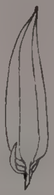
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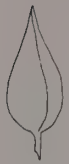
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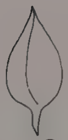
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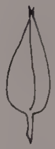
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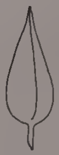
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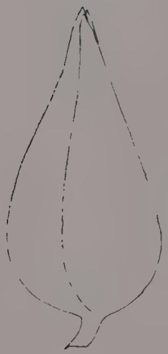
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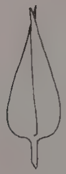
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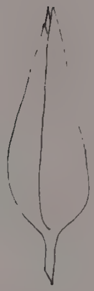
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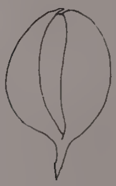
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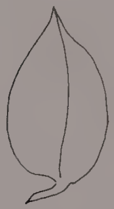
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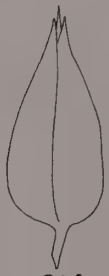
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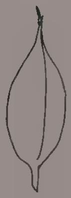
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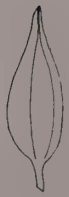
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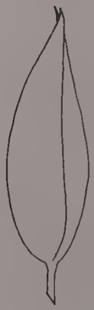
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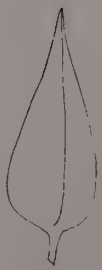

218

Sepals in *C. calycioides* and *C. aristellata* (Figs. 203 and 204) are equal in length but are narrower than those in all species of section *Chamaecrista* examined.

5. *Seed Form and Relief*

The first broad yet detailed study of seed structure and its application to the taxonomy of the Leguminosae was made by Capitaine (1912). Preliminary less intensive investigations had been made previously by Maisel (1909), Le Monnier (1872), and Planchon (1844). In his treatment of *Cassia,* Capitaine noted 3 basic morphological groupings: (1) seeds large, ovoid, little flattened, the surface glossy and smooth (*C. fistula* L., *C. javanica* L.); (2) seeds broadly to narrowly ovoid or sometimes angled and tapered, the plane surfaces with a variously shaped and often differently colored zone ("ligne") (*C. bicapsularis* L., *C. corymbosa,* Lam., *C. florida* Vahl (= *C. siamea* Lam.), *C. glauca* Lam., *C. hirsuta* L., *C. laevigata* Willd., *C. montana* Heyne, *C. obtusifolia* L., *C. occidentalis* L., *C. pilifera* Vog., *C. sophera* L., *C. timorensis* DC.); (3) seeds ovoid to rectangular or trapezoidal, flattened, surfacially marked with dots ("ponctuations") arranged in rows (*C. mimosoides* L., *C. nictitans* L.).

Corner (1951) confirmed Capitaine's conclusions regarding the similarity of caesalpinioid and mimosoid seed morphology, but dealt only parenthetically with *Cassia.* He termed the open oval or circular depressed line on the faces of mimosoid seeds the "pleurogram," and considered the wholly circumscribed, raised or depressed, area on the faces of seeds of certain *Cassia* species "an analogous modification." Burkart (1952) also noted that "linea fisural," of general occurrence in the *Mimosoideae,* was absent in *Cassia,* but recognized the differently colored zone on the faces of seeds of certain species.

Iseley, in the course of preparing a key to legume seeds (1955b) studied the seed morphology of six species of *Cassia* (1955a). These are *C. tora* L. (probably *C. obtusifolia*), *C. marilandica* L., *C. hebecarpa* Fern., *C. occidentalis, Chamaecrista fasciculata* (Michx.) Greene (= *Cassia fasciculata* Michx.), and *Chamaecrista nictitans* (L.) Moench (= *Cassia nictitans* L.). Since the seeds of the first 4 species were observed to have distinct "face lines" enclosing "face areas" while those of the last 2 had rows of fine pits, Iseley concluded that this difference supported generic segregation of the section *Chamaecrista.*

In the present investigation seeds of all taxa but 2 recognized as within the section *Xerocalyx* have been examined under the dissecting microscope. Drawings have been prepared of 3 seeds for each taxon in the section. One of each 3 has been amplified to show surfacial detail. Of the remaining 9 sections 1, *Chamaecrista,* is represented by 17 species, 7 sections by 3 species each, and 1 section, *Apoucouita,*

FIGS. 203–218. Floral buds of *Cassia* spp. in section *Chamaecrista,* × 1.8. FIG. 203. *C. calycioides* DC. FIG. 204. *C. aristellata* Cory & Parks. FIG. 205. *C. rotundifolia* Pers. FIG. 206. *C. tagera* L. FIG. 207. *C. serpens* L. FIG. 208. *C. trichopoda* Benth. FIG. 209. *C. choriophylla* Vog. var. *latifolia* Benth. FIG. 210. *C. tragacanthoides* Mart. FIG. 211. *C. drepanophylla* Benth. FIG. 212. *C. greggii* Gray. FIG. 213. *C. mucronata* Spreng. FIG. 214. *C. vestita* Vog. FIG. 215. *C. nictitans* L. FIG. 216. *C. leptadenia* Greenm. FIG. 217. *C. mimosoides* L. FIG. 218. *C. deeringiana* Macbr.

by a single species. In each case a single drawing was made. Drawings are represented in Figs. 219–285.

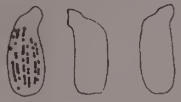
In surveying the variety of form and surface patterns, it may be noted that the basic scheme of Capitaine follows infrageneric lines quite closely, especially with regard to the subgenera of Bentham. The large seeds of the subgenus and section *Fistula,* Figs. 246–248, showed little surface detail except for cracks in the waxy coat. Seeds of species in the subgenus *Senna,* Figs. 249–263, vary considerably in size and form, but show uniformity in the presence of a patch ("face area" of Iseley) on each face. In *C. alata,* L., Figs. 260a and 260b, these patches lie on the edges near the hilum. In the subgenus *Lasiorhegma* pitted surfaces seem to be general in all 4 sections. However, in *C. apoucouita* Aubl., (Fig. 264), the sole representative of section *Apoucouita* examined in this study, the pits are minute, very numerous, and show no particular arrangement. This is in contrast to the larger, fewer pits which are arranged in rows in seeds of species from sections *Absus, Xerocalyx,* and *Chamaecrista.* While dimensional comparisons may be somewhat odious, it does seem worthy of note that in section *Chamaecrista* only one species of those examined, *C. basifolia* Vog. (Fig. 270), had seeds more than 1½ times longer than wide. In contrast, all of the seeds of the section *Xerocalyx* were found to be 1½ or more times longer than wide. Seeds of *C. calycioides* DC. and *C. aristellata* Cory & Parks (Figs. 268 and 269) agree in dimension and pit pattern with those of section *Chamaecrista.* Seeds of the 3 species of *Absus* represented appear rather intermediate in length-width measurement to those of sections *Xerocalyx* and *Chamaecrista.*

From this study 2 general observations may be made. First, the pitted seed faces, which some workers believed characteristic of *Chamaecrista* only, are found throughout the subgenus *Lasiorhegma.* Second, in section *Xerocalyx* the seeds are characteristically long and narrow, showing length-width ratios exceeding 1½:1. Elsewhere in the subgenus *Lasiorhegma* seed form is variable and, but for one known exception, the seeds are proportionately shorter.

FIGS. 219–233. Form and relief of seeds of *Cassia* spp. in section *Xerocalyx,* × 2.5. FIG. 219. *C. cultrifolia.* FIG. 220. *C. diphylla.* FIG. 221. *C. latistipula.* FIG. 222. *C. gracilis.* FIG. 223. *C. piribebuiensis.* FIG. 224. *C. piauhiensis.* FIG. 225. *C. langsdorffii* var. *latifoliola.* FIG. 226. *C. langsdorffii* var. *langsdorffii.* FIG. 227. *C. langsdorffii* var. *tenuis.* FIG. 228. *C. langsdorffii* var. *parvifoliola.* FIG. 229. *C. curvifolia* var. *mollissima.* FIG. 230. *C. curvifolia* var. *lucida.* FIG. 231. *C. curvifolia* var. *curvifolia.* FIG. 232. *C. ramosa* var. *ramosa.* FIG. 233. *C. ramosa* var. *maritima.*

FIGS. 234–245. Form and relief of seeds of *Cassia* spp. in section *Xerocalyx,* × 2.5. FIG. 234. *C. chartacea* var. *chartacea.* FIG. 235. *C. chartacea* var. *tenuicaulis.* FIG. 236. *C. tecta.* FIG. 237. *C. saxatilis.* FIG. 238. *C. bartlettii.* FIG. 239. *C. tetraphylla* var. *linearis.* FIG. 240. *C. tetraphylla* var. *ventuarensis.* FIG. 241. *C. tetraphylla* var. *aurivilla.* FIG. 242. *C. tetraphylla* var. *brevipes.* FIG. 243. *C. tetraphylla* var. *mollissima.* FIG. 244. *C. tetraphylla* var. *tetraphylla.* FIG. 245. *C. tetraphylla* var. *colombiana.*

FIGS. 246–263. Form and relief of seeds of *Cassia* spp. in sections *Fistula* (FIGS. 246–248), *Chamaefistula* (FIGS. 249–251), *Oncolobium* (FIGS. 252–254), *Prososperma* (FIGS. 255–257) ,*Chamaesenna* (FIGS. 258–260), *Psilorhegma* (FIGS. 261–263), × 2.5. FIG. 246. *C. fistula* L. FIG. 247. *C. grandis* L. f. FIG. 248. *C. ferruginea* Schrad. FIG. 249. *C. corymbosa* Lam. FIG. 250. *C. petersiana* Bolle. FIG. 251. *C. lindheimeriana* Scheele. FIG. 252. *C. gooddingii* A. Nels. FIG. 253. *C. hirsuta* L. FIG. 254. *C. marilandica* L. FIG. 255. *C. obtusifolia* L. FIG. 256. *C. uniflora* Mill. FIG. 257. *C. appendiculata* Vog. FIG. 258. *C. multijuga* L. C. Rich. FIG. 259. *C. emarginata* L. FIG. 260. *C. alata* L. FIG. 261. *C. sturtii* R. Br. FIG. 262. *C. artemisioides* Gaudich. FIG. 263. *C. desolata* F. Muell. var. *involucrata* F. M. Black.



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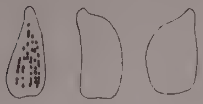

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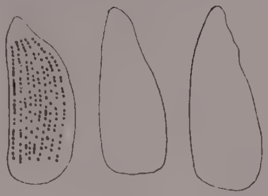

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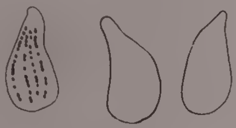

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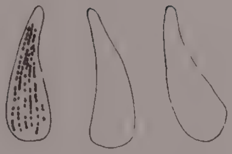

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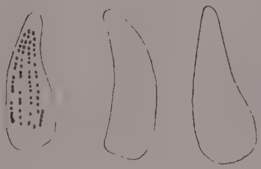

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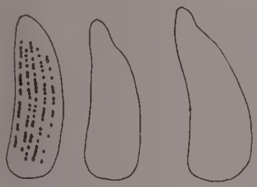

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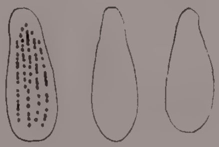

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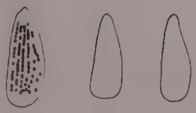

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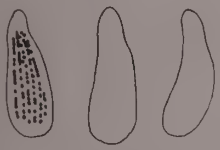

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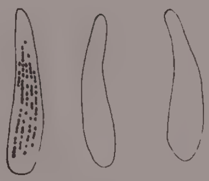

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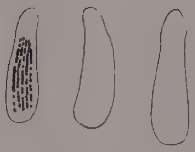

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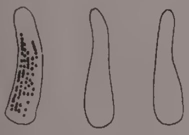

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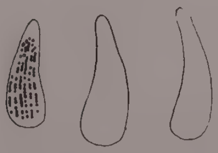

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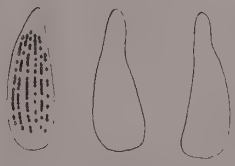

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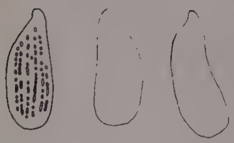

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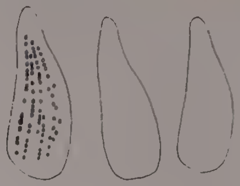

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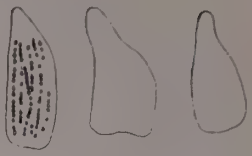

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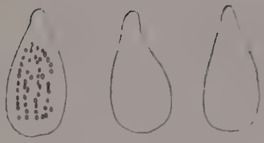

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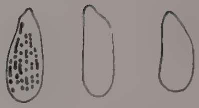

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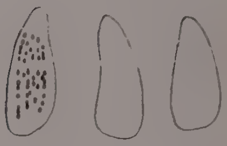

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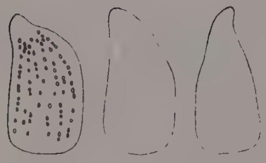

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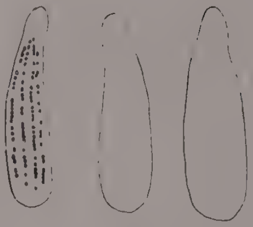

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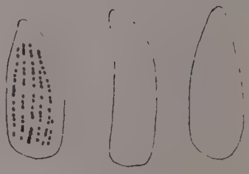

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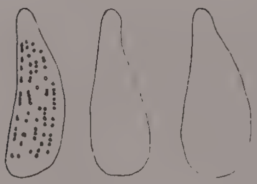

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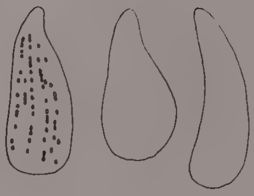

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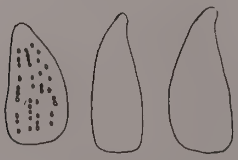

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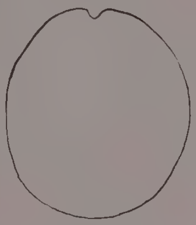
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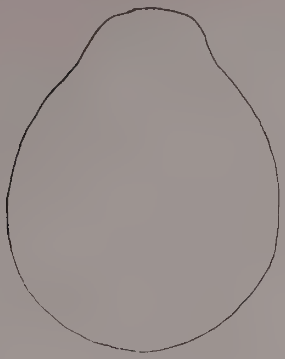
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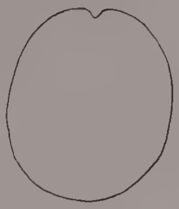
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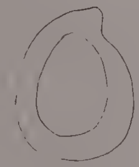
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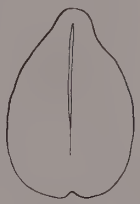
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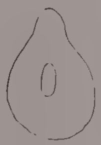
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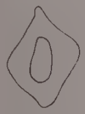
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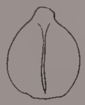
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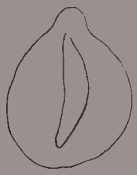
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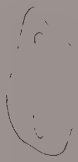
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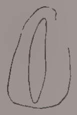
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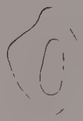
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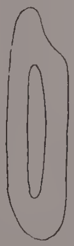
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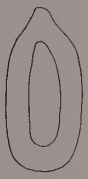
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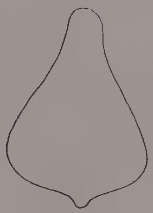
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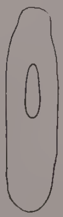
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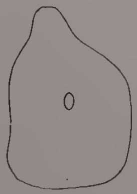
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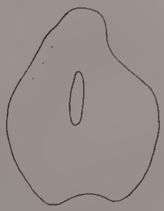
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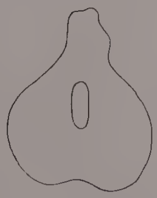
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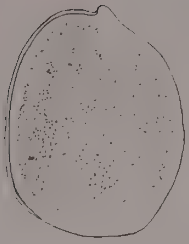
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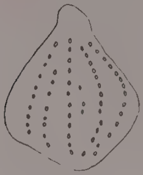
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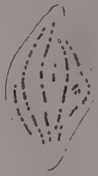
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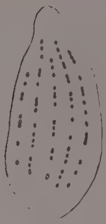
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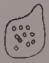
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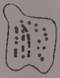
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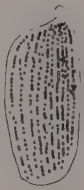
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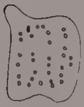
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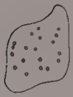
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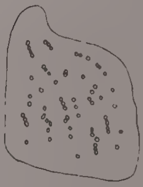
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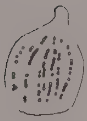
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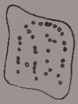
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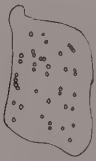
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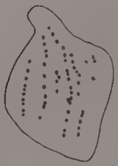
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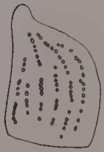
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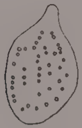
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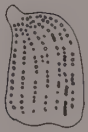
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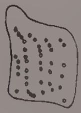
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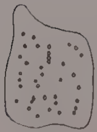
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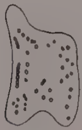
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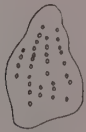
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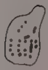
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Martin (1946), in a broad survey of internal seed morphology, noted that of the four species of *Cassia* examined, *C. ligustrina* L. (section *Chamaefistula*), *C. occidentalis* L. (section *Oncolobium*), and *C. fasciculata* Michx. (Section *Chamaecrista*) had the flat, spatulate embryo (including cotyledons) characteristic of the other 10 genera of Caesalpinioideae and the 6 genera of Mimosoideae studied, but that *C. tora* (section *Prososperma*) was unique in having irregularly much-folded cotyledons. This line of investigation will have to be expanded to include several species from each section before conclusions on internal patterns in *Cassia* can be reached.

6. *Other Morphological Characters*

Greene (1897) in his summary of the "superlatively numerous" characters purporting to support generic segregation of the section *Chamaecrista* (i.e. including the Benthamian subsection *Xerocalyx*), listed the following:

(1) Flowers axillary or supra-axillary and solitary or few and fascicled, never terminally clustered as in *Cassia*.

(2) Buds slender-conical and acuminate (always subglobose or ovoid and obtuse in *Cassia*).

(3) Sepals plane, slenderly acuminate, thin-membranous (in *Cassia* firm-herbaceous, obtuse, concave-convex).

(4) Flower on a twisted pedicel, its banner and keel petals thus made to appear lateral, and one wing enlarged and placed lowermost, the other reduced and becoming uppermost.

(5) Pods thin, compressed, very promptly dihiscent, never subterete and indehiscent as in most or all *Cassia*.

In the following discussion these points will be considered closely because they, in whole or part, have been the morphological bases referred to by all authors who have supported generic status for section *Chamaecrista*.

With regard to the first point, there is no instance known to the writer of a fasciculate[4] inflorescence in *Cassia*. Before this conclusion was reached, a careful survey was made of inflorescence types occurring in the genus. This survey was made by means of herbarium specimens, field observations, and published descriptions.

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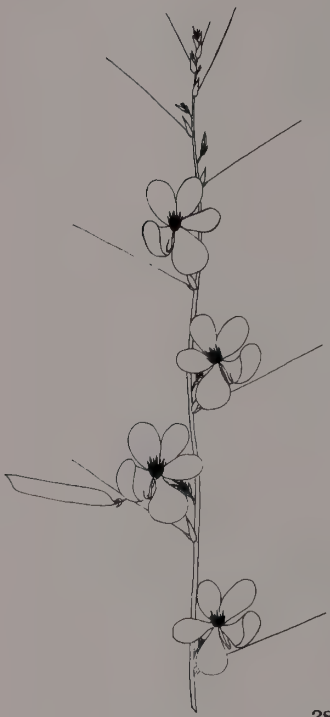
[4] Fascicle: a small bundle or collection, a compact cluster (Webster's New International Dictionary, G. C. Merriam & Co. 1949); a close cluster or bundle of flowers (Jackson, 1949); a tuft of branches (Willis, 1957); Fascicled: when several similar things proceed from a common point (Lindley, 1938).

FIGS. 264–285. Form and relief of seeds of *Cassia* spp. in sections *Apoucouita* (FIG. 264), *Absus* (FIGS. 265–267), *Chamaecrista* (FIGS. 268–285), × 2.5. FIG. 264. *C. apoucouita* Aubl. FIG. 265. *C. absus* L. FIG. 266. *C. hispidula* Vahl. FIG. 267. *C. debilis* Vog. FIG. 268. *C. calycioides* DC. FIG. 269. *C. aristellata* Cory & Parks. FIG. 270. *C. basifolia* Vog. FIG. 271. *C. rotundifolia* Pers. FIG. 272. *C. trichopoda* Benth. FIG. 273. *C. choriophylla* Vog. var. *latifolia* Benth. FIG. 274. *C. tragacanthoides* Mart. FIG. 275. *C. flexuosa* L. FIG. 276. *C. olesiphylla* Vog. FIG. 277. *C. greggii* Gray. FIG. 278. *C. mucronata* Spreng. FIG. 279. *C. serpens* L. FIG. 280. *C. fasciculata* Michx. var. *fasciculata*. FIG. 281. *C. stenocarpa* Vog. FIG. 282. *C. nictitans* L. FIG. 283. *C. leptadenia* Greenm. FIG. 284. *C. patellaria* DC. FIG. 285. *C. mimosoides* L.



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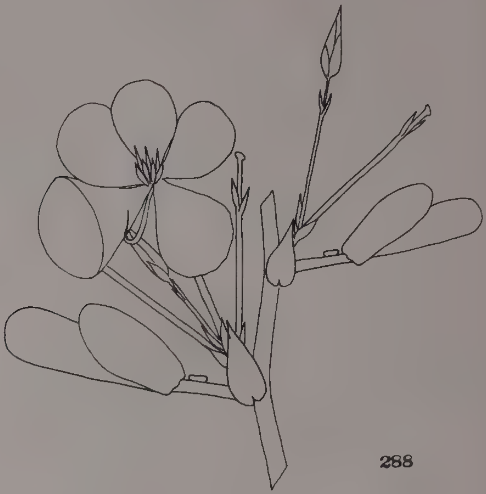

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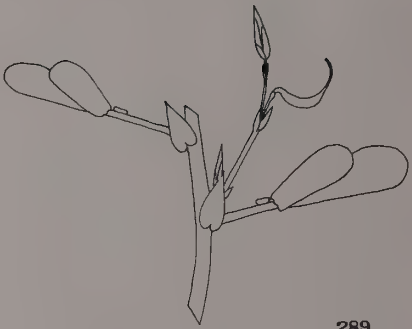

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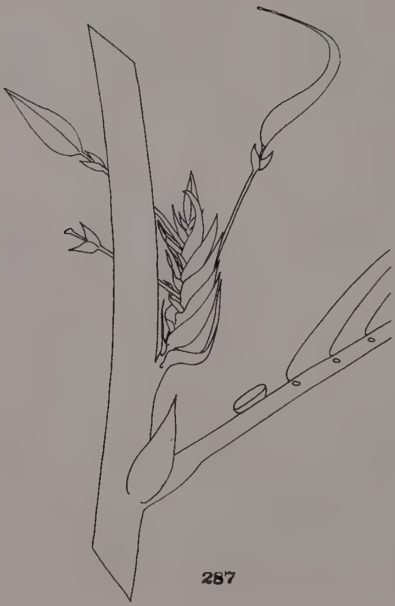

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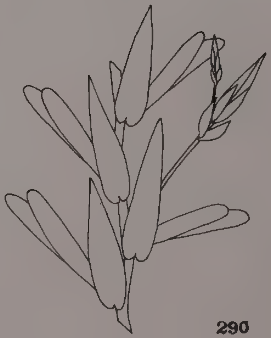

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It is quite clear that in *Cassia* the basic type of inflorescence organization is the raceme, as is seen in a relatively unmodified state throughout the subgenus and section *Fistula*. In the subgenus *Senna* inflorescences may range from axillary racemes, sometimes considerably reduced, to terminal panicles, with a few instances of terminal racemes occurring in section *Chamaesenna*, series *Pictae* and series *Brachycarpae*. In the subgenus *Lasiorhegma* deviation from the basic racemose pattern takes 3 courses. The relatively few species in section *Apoucouita* have latently developing lateral racemes, a situation which might be considered cauliflory, especially in *C. apoucouita*. Section *Absus* shows uniformity in the production of simple or compound terminal racemes. In section *Chamaecrista* the basic pattern appears to be an axillary raceme, but this is usually reduced to a considerable extent, in many species to a single flower. However, the persistence of both bracts and bracteoles and the relation of these structures to the racemose pattern in such species of section *Chamaecrista* where that pattern persists, bears testimony to the underlying racemose inflorescence. In several species axillary racemes, while considerably condensed, remain essentially intact. *C. fasciculata* demonstrates this condition especially well. While it is true that the axis is condensed when the first flower opens and that an interval of few to several days elapses between the maturing of successive flowers in one inflorescence, the racemose pattern at length becomes clear. (Fig. 287.)

In section *Xerocalyx* solitary flowers are most usual, but here, as in *Chamaecrista*, there are 2 sets of bracts: 1 or 2 at the base of the floral axis and a subopposite pair closer to the flower. In several populations of *C. tetraphylla* Desv., from which specimens were collected by the writer (*Irwin 34, 656, 765, 2535*), vigorous plants bore condensed axillary racemes (Fig. 288), closely resembling those found generally in *C. fasciculata*. The basal bract of the more common solitary flower is readily referred to the bracts of the raceme axis, and the more distal pair are bracteoles of the pedicel. Thus, in solitary flowers, the floral axis is composed of 2 distinct parts: the vestige of the raceme axis, often short or obscure, terminating with a bract, and the pedicel with a pair of bracteoles.

In 2 instances, each involving a different species, a single lateral branch could be seen arising in the axil of one of the bracteoles (Figs. 289 and 290). Although this condition may best be interpreted as a casual aberration, in light of the observations of inflorescence patterns in the whole genus, it could be speculated that at some earlier time panicles occurred in *Xerocalyx*. In any case it is clear that the solitary disposition of flowers most commonly encountered in section *Xerocalyx* and quite commonly in section *Chamaecrista* is a condition derived from the racemose pattern basic for the genus.

Greene's second character, that buds in *Chamaecrista* are "slender-conical or acuminate" but "always subglobose or ovoid" in *Cassia*, is generally valid but, in

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FIGS. 286–290. Inflorescence structure of *Cassia* spp. in sections *Chamaecrista* and *Xerocalyx*. FIG. 286. Enantiostyly in *C. fasciculata* Michx. var. *fasciculata*, prepared from living material, × 0.4. FIG. 287. Inflorescence detail of *C. fasciculata* Michx. var. *fasciculata*, prepared from living material × 2.5. FIG. 288. Inflorescence detail of *C. tetraphylla* var. *tetraphylla*, prepared from *Irwin 656*, × 1.8. FIG. 289. Inflorescence branching in *C. tetraphylla* var. *tetraphylla*, prepared from *Irwin 2535*, × 1.2. FIG. 290. Inflorescence branching in *C. langsdorffii* var. *langsdorffii*, prepared from *Irwin 2601*, × 1.2.

the case of the former, subject to one clear exception in *C. greggii* Gray, a low shrub of northeastern Mexico and adjacent Texas, which agrees in all respects with Bentham's sectional (and Greene's generic) characters for *Chamaecrista* except for ovoid round-ended buds.

More germane to the present discussion is the matter of degree of acuteness in buds of section *Chamaecrista* as compared with those of section *Xerocalyx*. In buds of the 14 species of section *Chamaecrista* shown in Figs. 205–218, it is clear that the length-width ratio does not exceed 6:2½, whereas in all species of section *Xerocalyx*, and in *C. alycioides* DC. and *C. aristellata* Cory & Parks, the same ratio is greater than 3:1. As has been noted, all species of section *Xerocalyx* bear sepals of unequal length, while those of *C. calycioides* and *C. aristellata* and the section *Chamaecrista* are quite equal.

Concerning the third point raised by Greene, that of sepal form and texture, *C. greggii* is again an exception, in this case because of its short, blunt, cupped sepals. Of course, sepal form is closely related to bud form, about which much has already been said. Textural differences in *Cassia* sepals are largely reflective of venation patterns and cuticularization. These vary greatly within the genus. The homogeneity and distinctness of sepal venation in section *Xerocalyx* has already been pointed out.

In the course of his observations on the apparently disrupted symmetry of the corolla in *Cassia fasciculata* Michx. (= *C. chamaecrista* L.) Greene assumed that of the 5 petals, the inturned somewhat hooded one is the banner, and that therefore the flower must be turned 90° to the left, with the then inferior wing petal enlarged and the superior wing reduced to the size of the 2 keel petals. Evidently Greene did not make this observation from flowers attached to living plants. Observation of attached flowers shows quite clearly that here, as elsewhere in the genus, enantiostyly is displayed. This phenomenon, which involves simultaneous production of heterodromous flowers, has been well demonstrated in Marantaceae, *Exacum, Saintpaulia, Klugia,* etc. As is seen in Fig. 28, dextrostylous flowers consistently occur in the inflorescences on the right side[5] of the stem, while sinistrostylous occur on the left. This same arrangement has been noted by the present writer in many species of the section *Chamaecrista,* e.g. in all North American and many South American species of the series Chamaecristae verae, and in *C. rotundifolia* Pers. and *C. serpens* L. of the series *Prostratae.* It also occurs in at least 6 taxa in section *Xerocalyx,* i.e. *C. tetraphylla* Desv. var. *tetraphylla, C. tetraphylla* var. *mollissima* (Benth.) Irwin, *C. langsdorffii* Kunth var. *langsdorffii, C. langsdorffii* var. *parvifoliola* Irwin, *C. diphylla* L., and *C. cultrifolia* H.B.K. In this section, however, it can be detected only after repeated examination of single plants, since *Xerocalyx* species have never been observed to be as floriferous as *C. fasciculata* and its allies.

In other sections of *Cassia* enantiostyly is especially well displayed in *C. biflora* L. (section *Chamaesenna*), the peduncles of which are usually simultaneously 2-flowered, one flower being an exact reflection of the other. *C. fruticosa* Mill., *C. latifolia* G. F. W. Mey, and *C. hilariana* Benth. (all of section *Chamaefistula*) show this condition in lesser degree, without the heterodromy so well ordered.

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[5] In the majority of species of section *Chamaecrista,* flowering stems are disposed in a horizontal or ascending position, rarely strictly erect, and in all species the inflorescences and subtending leaves are distichous. Reference here is given acropetally from above such a shoot.

In review, the significance of the heterodromous flowers of *C. fasciculata* Michx. was not grasped by Greene since he failed to relate the phenomenon to the position of flowers on the plant. Furthermore, the enantiostylous condition has been observed to occur not only in 6 additional species in section *Chamaecrista,* but also in 6 taxa in section *Xerocalyx* and in several taxa elsewhere in the genus. Owing to the overall homogeneity shown in section *Xerocalyx,* it may be speculated that enantiostyly is of general occurrence in the section. However, because the occurrence of the character has been inadequately determined in other sections, it must be presently regarded as of limited value in inter-sectional segregation.

Perhaps more than any other, Greene's fifth point, that concerning fruit characters, reveals the narrow and purely regional scope of his work. Bentham (1871) stated that compressed dehiscent pods are general in the subgenus *Lasiorhegma* and that prompt dehiscence is characteristic in both his sections *Chamaecrista* and *Absus.* Since *Xerocalyx* was included in Bentham's concept of the section *Chamaecrista,* it goes without saying that prompt dehiscence is characteristic of the former taxon.

It should be reaffirmed that in the above discussion Greene's work was considered rather closely because he, more than any other, attempted to support with a series of morphological observations the still commonly held notion that the section *Chamaecrista* is deserving of generic status. However, it may be seen that the generalizations he drew are in fact of narrow application in the genus as a whole, very largely because of his small sample. It is also clear that the section *Xerocalyx,* while bearing close morphological similarity to section *Chamaecrista,* is nonetheless distinct in many respects.

Dormer (1955) has discussed phyllotaxy as a character of considerable value in distinguishing infrageneric taxa in *Cassia.* In reviewing the results of Dormer's study it may be seen that in each of the 3 subgenera both spiral and distichous phyllotaxy occur. In the subgenus *Lasiorhegma* all of the 72 species of the section *Chamaecrista*[6] which Dormer examined were distichous while all but 2 species of the section *Absus* appeared spiral. Dormer mentions the curious fact that Bentham, who gave no evidence of having consciously recognized phyllotaxy as a character, considered *C. coriacea* Bong., one of the 2 known Absi to have distichous phyllotaxy, as most nearly resembling the Chamaecristas. But Dormer did not mention that in some species of section *Chamaecrista,* e.g. *C. rotundata* Vog. and *C. choriophylla* Vog., the distichous condition in some measure approaches the spiral arrangement, owing to the gentle spirals formed by the 2 ranks of foliar organs. In section *Xerocalyx* the distichous state is unvarying, the 2 ranks forming straight opposite files.

In a preliminary palynological survey, Graham (personal communication) examined pollen samples from 41 species of *Cassia,* representing all sections but *Apoucouita.* Included were samples from 5 species of section *Chamaecrista* and 2 from section *Xerocalyx.* Dimensionally, the pollen of the 2 *Xerocalyx* species was found to be largest (57 x 45μ in *C. tetraphylla* Desv. var. *tetraphylla*) while that of representatives of section *Chamaefistula,* series *Brachycarpae,* was smallest (diameter of 25μ in *C. lindheimeriana* Scheele). However, the pollen of all species examined was morphologically similar, to the extent that, for the present at least, pollen characters offer no useful tool in *Cassia* taxonomy.

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[6] Section *Chamaecrista* in Bentham's sense, i.e. including the here recognized section *Xerocalyx.*

In a study of apical organization and vascular development in roots of 42 species of *Cassia,* Hayat (1959) found no fundamental differences between patterns exhibited by woody and herbaceous species, nor was there any clear correlation between pattern and taxonomic position of the respective species in the genus. Individual species, especially herbaceous ones, did in some cases display distinct xylem patterns, but, in general, closely related species (e.g. *C. bicapsularis* L. and *C. laevigata* Willd.; *C. fasciculata* Michx. and *C. mimosoides* L.) had overlapping patterns. Section *Xerocalyx* was represented by one species, *C. cultrifolia* H.B.K.

CHROMOSOME NUMBERS

The details and significance of chromosome numbers known for *Cassia* have been discussed elsewhere (Irwin & Turner, 1960). However, it would be useful here to summarize and supplement the data presented therein which apply to sections *Chamaecrista* and *Xerocalyx.* Of the 29 taxa of section *Chamaecrista* [7, 8] for which counts are known, 21 are diploid with $n = 8$ or $2n = 16$. Four species are tetraploid with $n = 16$ or $2n = 32$, and for one species, *C. leschenaultiana* DC., a polyploid series, $2n = 16, 32, 48$, has been reported. Fourteen collections of species assignable to section *Xerocalyx* have been examined, all showing $n = 7$ (Figs. 291–301). *C. calycioides* DC. and *C. aristellata* Cory & Parks[9] both have $n = 8$ (Figs. 308 and 309). Thus it is clear that the basic number for section *Xerocalyx* is $x = 7$ while that for section *Chamaecrista* is $x = 8$ (Figs. 310–328). On this basis *C. calycioides* and *C. aristellata* show greater affinity to the latter than to section *Xerocalyx.* As has been noted and may be deduced from Table II, placement of these species in section *Chamaecrista* is proposed on the strength of all evidence now at hand. It is not to be inferred from this transfer that *C. calycioides* and *C. aristellata* will be so natural in section *Chamaecrista* as to be assignable to an existing series. Present chromosomal and morphological evidence suggests rather that their position is intermediate between the 2 sections concerned, but showing more affinity to section *Chamaecrista.* Bentham's placement of *C. calycioides* in a subcategory alone at the end of his treatment of subsection *Xerocalyx* indicates his awareness of this intermediacy.

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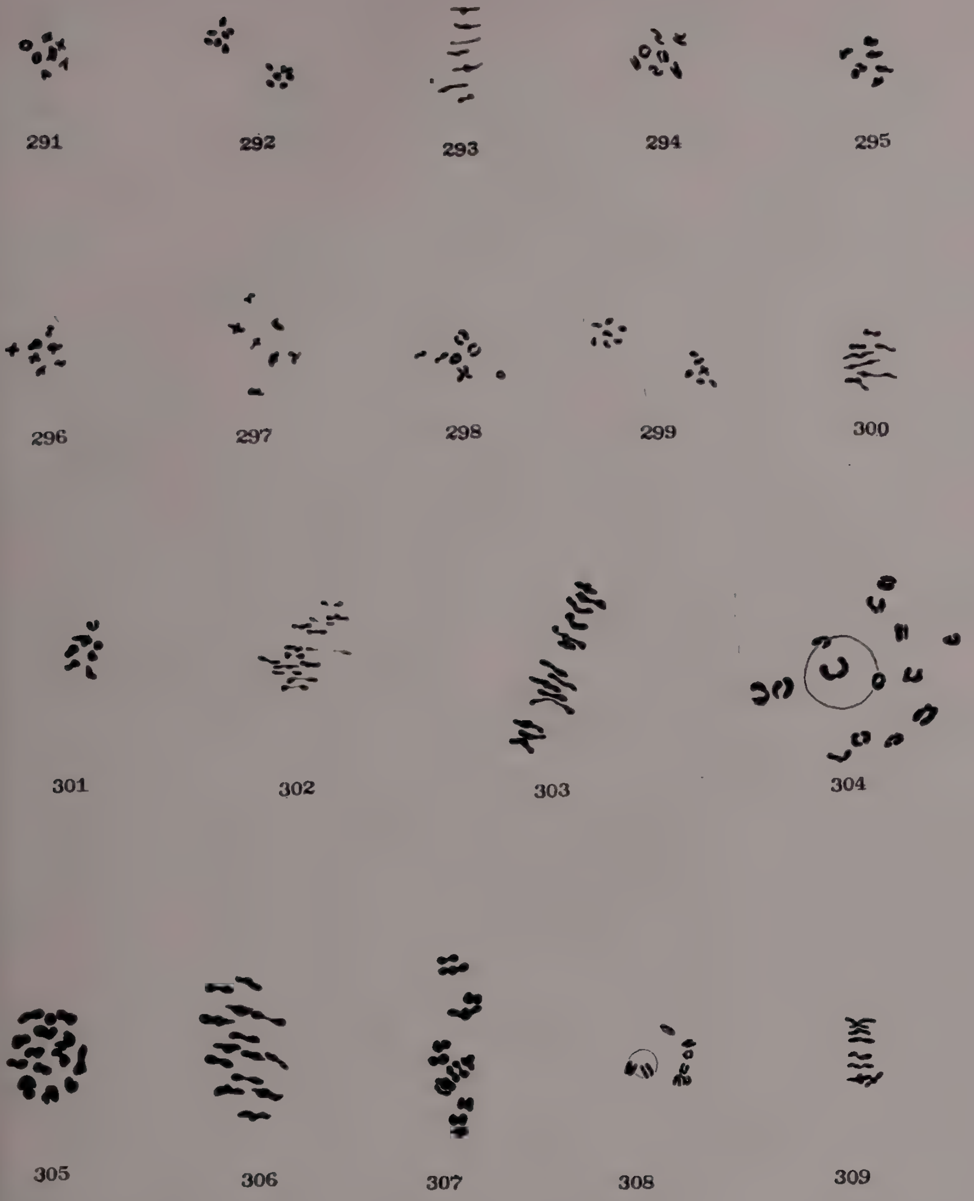
[7] Including *C. greggii* Gray with $n=8$ (*M. C. Johnston 4601;* Mexico, Nuevo Leon, 11 miles NE of Sabinas Hidalgo, 5 miles SW of Vallecillos; 10 November 1959).

[8] Excluding *H. S. Irwin 606,* misidentified as *C. stenocarpa* Vog. but on close examination proving to be *C. calycioides* DC.

[9] Reported by Irwin & Turner (1960) under section *Chamaecrista.*



FIGS. 291–309. Camera lucida drawings of meiotic chromosomes of *Cassia* spp. in sections *Xerocalyx* (FIGS. 291–301), *Absus* (FIGS. 302–307), *Chamaecrista* (FIGS. 308–309), ca. × 1200. FIG. 291. *C. cultrifolia, Irwin 617, n* = 7. FIG. 292. *C. diphylla, Irwin 1390, n* = 7. FIG. 293. *C. latistipula, Irwin 2359, n* = 7. FIG. 294. *C. langsdorffii* var. *langsdorffii, Irwin 2568, n* = 7. FIG. 295. *C. langsdorffii* var. *parvifoliola, Irwin 2429, n* = 7. FIG. 296. *C. ramosa* var. *ramosa, Irwin 587, n* = 7. FIG. 297. *C. malacophylla, Irwin 2435, n* = 7. FIG. 298. *C. tecta, Irwin 2425, n* = 7. FIG. 299. *C. tetraphylla* var. *brevipes, Irwin 2580, n* = 7. FIG. 300. *C. tetraphylla* var. *mollissima, Irwin 2612, n* = 7. FIG. 301. *C. tetraphylla* var. *tetraphylla, Irwin 656, n* = 7. FIG. 302. *C. viscosa* H.B.K., *Irwin 586, n* = 14. FIG. 303. *C. hedysaroides* Vog., *Irwin 2490, n* = 14. FIG. 304. *C. lamprosperma* Mart., *Irwin 2479, n* = 14. FIG. 305. *C. secunda* Benth., *Irwin 2391, n* = 14. FIG. 306. *C. debilis* Vog., *Irwin 2458, n* = 14. FIG. 307. *C. cathartica* Mart., *Irwin 2357, n* = 14. FIG. 308. *C. calycioides* DC., *Irwin 646, n* = 8. FIG. 309. *C. aristellata* Cory & Parks, *Irwin 1403, n* = 8.

TABLE II

Cassia calycioides and *C. aristellata* in Comparison with Sections *Xerocalyx, Chamaecrista,* and other Infrageneric Taxa

Infrageneric groups	Subgenus *Lasiorhegma*	
Irwin:	Sect. *Xerocalyx*	*C. calycioides* *C. aristellata*
Bentham:	Sect. *Chamaecrista,* Subsect. *Xerocalyx*	
Characters		
Basic chromosome numbers	x = 7	x = 8
Number of main bundles at mid-petiole	3	3
Continuity of collenchyma	continuous, open or closed	discontinuous
Ridge bundles, number per ridge	1	1
Position of vascular elements in ridge bundles	abaxial	lateral or abaxial
Position of foliolar midrib	absent	eccentric
Secondary venation, pattern	divergent, then parallel[g]	pinnate, but parallel
Visible anastomosis	little, mostly at margin	marginal
Change from basic racemose pattern in inflorescence: unchanged (0); elaborated (+); reduced (–)	–	–
Equality of sepals	unequal	equal[j]
Sepal venation	parallel	parallel
Anastomosis in sepal venation	marginal or none	marginal
2-dimensional form of seed from plane surface	narrowly ovoid or narrowly triangular	square or trapezoidal
Seed surface: face areas (F); pitted in lines (L); irregularly pitted (PI); no relief (0).	PL	PL, PI

[a] See Irwin & Turner (1960) for a discussion of presumed aneuploid changes in these subgenera.

[b] 4 principal and 2 subsidiary bundles in *C. hedysaroides.*

TABLE II (cont'd)

Subgenus *Lasiorhegma*			Subgenus *Senna*	Subgenus *Fistula*
Section *Chamaecrista*	Section *Absus*	Section *Apoucouita*		
Sect. *Chamaecrista*, Subsect. *Leiocalyx*				
x = 8	x = 14	x = ?	x = 14, 13, 12, 11[a]	x = 14, 12[a]
3	basically 3[b]	3	basically 3	3
continuous, open[c]	discontinuous	mostly continuous	discontinuous[d, e]	continuous, open or closed
1	1	1–3	1–2[f]	1–2
lateral or abaxial	lateral or adaxial	various	abaxial	abaxial
central, eccentric or marginal	central	central	central	central
pinnate, few parallel	pinnate	pinnate[b]	pinnate	pinnate
marginal or general	general	general[h]	general	general
–	0, +	0[i]	0, +	0
equal	equal	equal	equal	equal
pinnate	pinnate	pinnate	pinnate	pinnate
mostly general	general	general	general	general
ovoid, square, trapezoidal, parallelogrammatic	ovoid, trapezoidal, parallelogramatic	ovoid[h]	various[k]	ovoid
PL, PI	PL	PI[h]	F	0

[c] Closed in *C. basifolia*.

[d] Amphivasal in *C. lindheimeriana*.

[e] Continuous in section *Oncolobium* and *C. reticulata* (*Chamaesenna*, series *Pictae*).

[f] Obscure in *C. reticulata*.

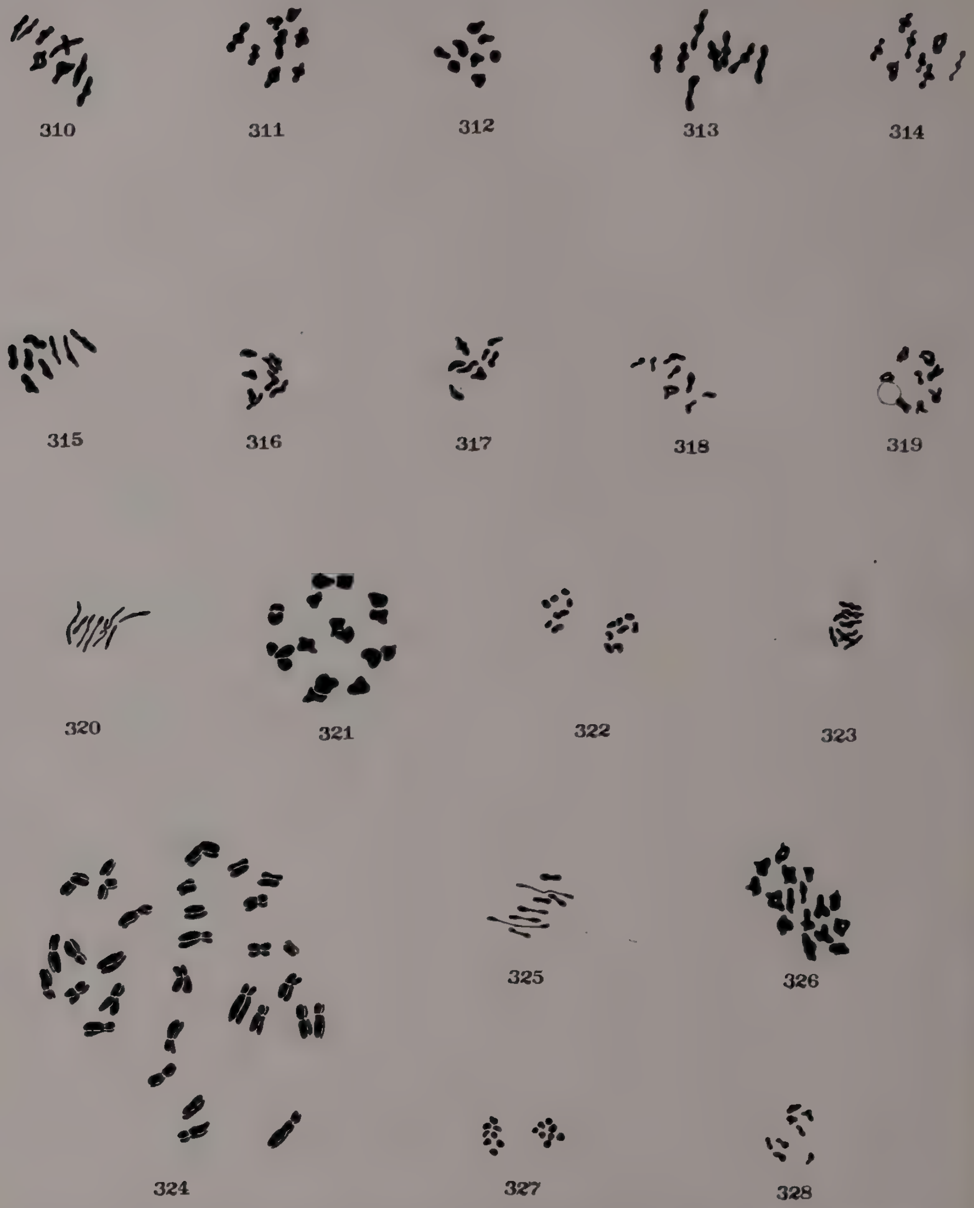
[g] In *C. diphylla, C. gracilis,* and *C. tetraphylla* var. *linearis* secondary venation, often pinnate but parallel, most nearly approaches the patterns of *C. calycioides* and *C. aristellata*.

[h] Only 1 sp. examined (*C. apoucouita*).

[i] Latently developing in *C. apoucouita* (i.e. cauliflorous).

[j] But, as is seen in Figs. 203 and 204, tending to be valvate; imbrication is general elsewhere.

[k] Seed of *C. alata* with a buttress-like ridge on each side, developing at right angles to plane of face area.



FIGS. 310–328. Camera lucida drawings of meiotic chromosomes (FIGS. 310–323, 325–328) and somatic chromosomes (FIG. 324) of *Cassia* spp. in section *Chamaecrista*, ca. × 1200 except where otherwise noted. FIG. 310. *C. basifolia* Vog., *Irwin 2554*, $n = 8$. FIG. 311. *C. rotundifolia* Pers., *Irwin 2013*, $n = 8$. FIG. 312. *C. serpens* L., *Irwin 1447*, $n = 8$. FIG. 313. *C. trichopoda* Benth., *Irwin 2386*, $n = 8$. FIG. 314. *C. supplex* Mart., *Irwin 2549*, $n = 8$. FIG. 315. *C. cinerascens* Vog., *Irwin 2473a*, $n = 8$. FIG. 316. *C. flexuosa* L., *Irwin 592*, $n = 8$. FIG. 317. *C. mucronata* Spreng., *Irwin 2502*, $n = 8$. FIG. 318. *C. fasciculata* Michx. var. *fasciculata*, *Irwin 1416*, $n = 8$. FIG. 319. *C. fasciculata* Michx. var. *puberula* (Greene) Macbride, *Irwin 1424*, $n = 8$. FIG. 320. *C. fasciculata* Michx. var. *rostrata* (Woot. & Standl.) Turner, *Irwin 1412*, $n = 8$. FIG. 321. *C. stenocarpa* Vog., *Irwin 2014*, $n = 16$. FIG. 322. *C. riparia* H.B.K., *Irwin s.n.*, $n = 8$. FIG. 323. *C. nictitans* L., *Irwin 1460*, $n = 8$. FIG. 324. *C. patellaria* DC., *Irwin 2012*, $2n = 32$, ca. × 2000. FIG. 325. *C. mimosoides* L. var. *mimosoides*, *Irwin 1461*, $n = 8$. FIG. 326. *C. mimosoides* L. var. *mimosoides ?*, *Irwin 2369*, $n = 16$. FIG. 327. *C. mimosoides* L. var. *africana* Steyaert, *Irwin 1462*, $n = 8$. FIG. 328. *C. texana* Buckl., *Irwin 1401*, $n = 8$.

CHROMATOGRAPHIC STUDIES

The application of chromatography to plant taxonomy has only recently been investigated, the suggestion for its possible use having been made by Gibbs (1954). Alston and Turner (1959) have studied hybrid swarms in *Baptisia,* noting a high degree of correlations between morphological and chromatographed biochemical recombinations. In another paper Turner and Alston (1959) discuss more fully the taxonomic implications of the same study, and propose its extension throughout *Baptisia* and other genera where "biochemical profiles" should be useful tools in taxonomic problems. Alston and Irwin (1961) compared variation in chromatograms of free amino acids and secondary substances in 5 species of *Cassia,* noting that in a large variable group amino acid variation is of considerable value. Auguring well for further studies along this line was the discovery by Alston and Irwin (1961) that flowers dried at 30–50°C for 9–40 hr provide results equivalent to those obtained with fresh material, and quite superior to frozen. Thus, the way may be open for chromatographic examination of herbarium material.

Relevant to the present study, dried flowers, some dessicated according to the 45–50°C/9–16 hr schedule mentioned above, others merely removed from especially floriferous herbarium specimens, were processed and chromatograms were prepared according to the method for "secondary substances"[10] described by Alston and Irwin (1960). The solvent used was acetic acid: water (15 : 85 v/v), following pretreatment with a short run in petroleum ether.

Two series of tests were made. In the first, an attempt was made to establish degrees of difference and likeness both within each of the sections *Absus, Xerocalyx,* and *Chamaecrista,* as well as among them. It seemed necessary to do this since our previous work with *Cassia* had been done with isolated representatives, some 25 in all, from all sections of the genus, and whose patterns, when considered overall, showed about the same degree of variation as seen in Figure 1 of Alston and Irwin's (1961) paper. In Fig. 329 and Figs. 331 and 332 the patterns of the species tested in the present investigation are represented.

Among 4 species of the section *Absus* tested (A, B, C, D) there is community of pattern, but the last, E, is unlike any other sample either within or without this section. In this chromatogram it was noted that 2 low Rf spots, which are dark under UV (ultraviolet light), turn yellow in sulfanilic acid spray. However, some of the bands present in other Absi appear to be in E also, e.g. the upper blue band, but these have been observed to be of rather general occurrence in the genus. Some differences appear among the remaining 4 *Absus* samples. A dark band, olive green in ammonia vapor and UV (Rf ca. 70) is present in C and D but nowhere else. However, the low Rf bright blue component of C is concentrated in A, but present in low concentration in D. A has a yellow (blue in UV) band (Rf ca. 35) absent in C and D. A gray streak appearing in sulfanilic spray in D is present in lower concentration in C, but is absent from A and B. Thus C and D seem most similar to each other, somewhat distant from A, and quite distant from B. Again, E does not show close affinity to any, but this may in part be due to streaking.

Interpretation in the *Chamaecrista* representatives (J, K, L, M) must be tempered

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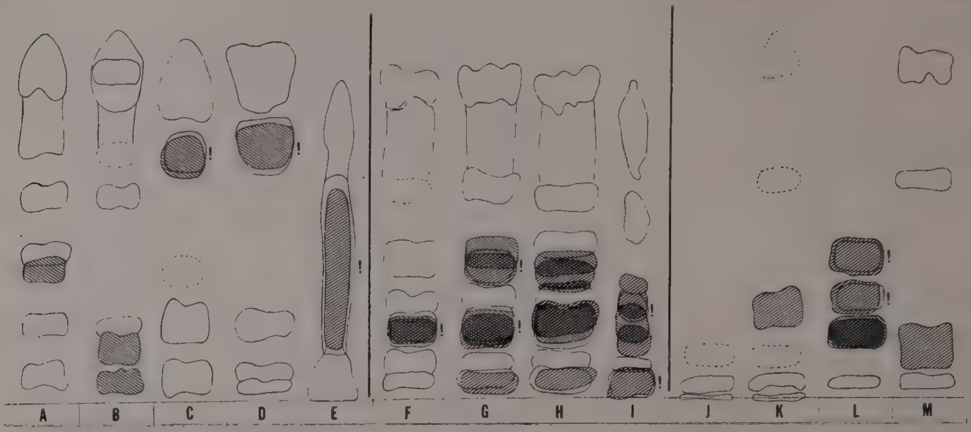
[10] In this study chromatograms were prepared and in large part interpreted by R. E. Alston, Dept. of Botany, University of Texas.



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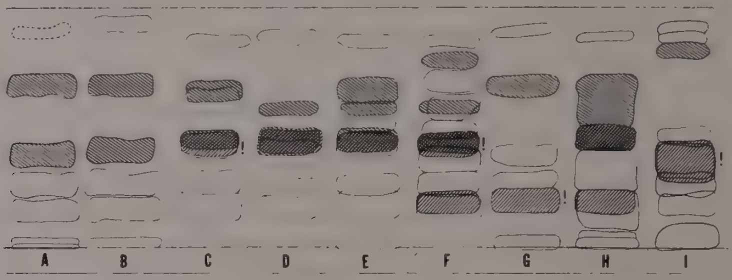

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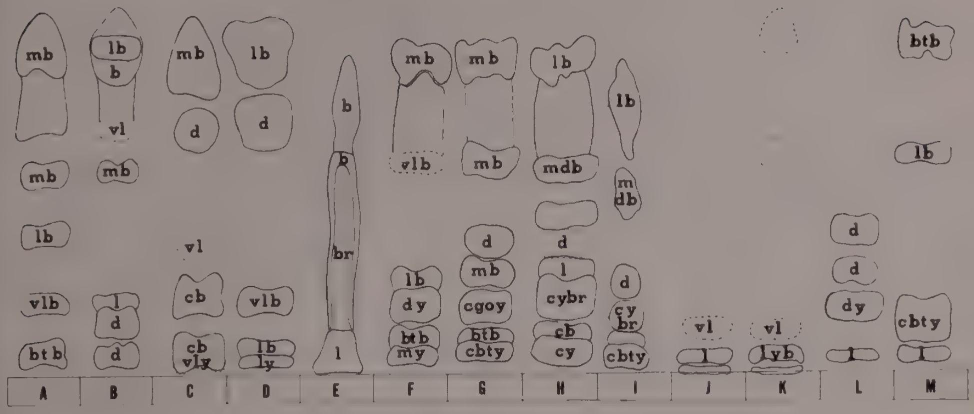
FIGS. 329, 330. Composite chromatograms of flowers of *Cassia* spp. showing spots seen under UV without NH_3 vapor (unshaded), under UV in NH_3 vapor (grid lines sloping upward to left), and in daylight (grid lines sloping upward to right). Broken lines indicate barely visible spots. The symbol ! indicates location of spot visible in UV without NH_3 vapor (i.e. unshaded) quite or nearly obscured by shaded spots. FIG. 329. *Cassia* spp. in sections *Absus* (A–E), *Xerocalyx* (F–I), and *Chamaecrista* (J–M). A. *C.* aff. *sophoroides* Mart. B. *C. debilis* Vog. C. *C. benthamiana* Harms. D. *C. dalbergiaefolia* Benth. E. *C.* aff. *nummulariaefolia* Benth. F. *C. langsdorffii* var. *parvifoliola*. G. *C. tecta*. H. *C. langsdorffii* var. *langsdorffii*. I. *C. tetraphylla* var. *tetraphylla*. J. *C. patellaria* DC. K. *C. fasciculata* Michx. var. *rostrata* (Woot. & Standl.) Turner, white corolla. L. *C. fasciculata* Michx. var. *rostrata* (Woot. & Standl.) Turner, yellow corolla. M. *C. serpens*. L. FIG. 330. *Cassia* spp. in section *Xerocalyx* (A–H) and *C. calycioides* DC., section *Chamaecrista* (I). A. *C. cultrifolia*. B. *C. diphylla*. C. *C. langsdorffii* var. *parvifoliola*. D. *C. langsdorffii* var. *langsdorffii*, E. *C. tecta*. F. *C. malacophylla*. G. *C. curvifolia* var. *curvifolia*. H. *C. tetraphylla* var. *tetraphylla*. I. *C. calycioides* DC.

somewhat since J and K were prepared from frozen material, such material having been noted by Irwin and Alston (unpublished) as often productive of rather inferior results. Nonetheless, the streaks produced by J and K are similar to those shown by L; in fact the only significant difference between K and L is the near or complete absence of anthocyanins in the former. While at first the anthocyanins evident in L might be attributed to the deep red anthers in that taxon, it will be noted that anthocyanins also appear in G and H, both yellow-anthered representatives of section *Xerocalyx*. Conspicuously absent from the patterns of *Chamaecrista* species tested are strongly fluorescing bands of high Rf.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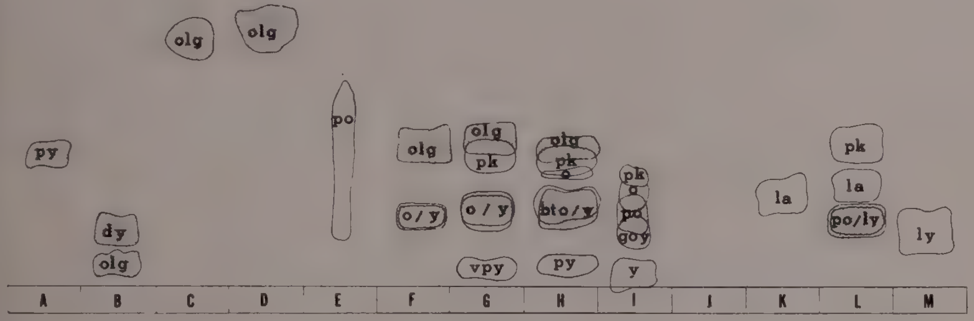
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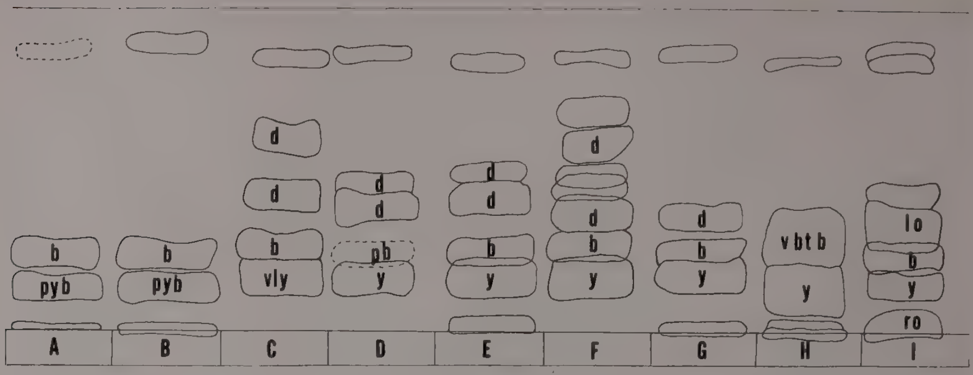
FIGS. 331, 332. Portions of chromatograms of flowers of *Cassia* spp. shown in FIG. 329 separated according to conditions employed in viewing, indicating colors displayed. FIG. 331. Spots and colors visible in UV with NH_3 vapor. Colors: b = blue; br = brown; g = green; go = golden; la = lavender; o = orange; ol = olive; pk = pink; r = red; y = yellow. Qualities: bl = brilliant; bt = bright; c = clear; d = dark (when alone: dark tan or fawn); l = light (when alone: light tan or fawn); m = medium; p = pale; v = very. FIG. 332. Spots and colors visible in UV without NH_3 vapor (stippled, and colors indicated to left of slashes (/)) and in daylight (unshaded, and colors indicated to right of slashes). Colors and qualities as with FIG. 331.

In general, the following observations may be made: (1) Of the 3 sections represented here, the greatest homogeneity among species tested lies in the section *Xerocalyx;* (2) among the 5 representatives of the section *Absus,* 4 show similar patterns, although these are far more varied than those in section *Xerocalyx,* and one, *C.* aff. *nummulariaefolia* Benth., stands apart as quite distinct from any *Cassia* examined thus far; (3) representatives of the section *Chamaecrista* show the least degree of overall interrelationship, but there is no marked deviation comparable to that displayed by E in section *Absus.*



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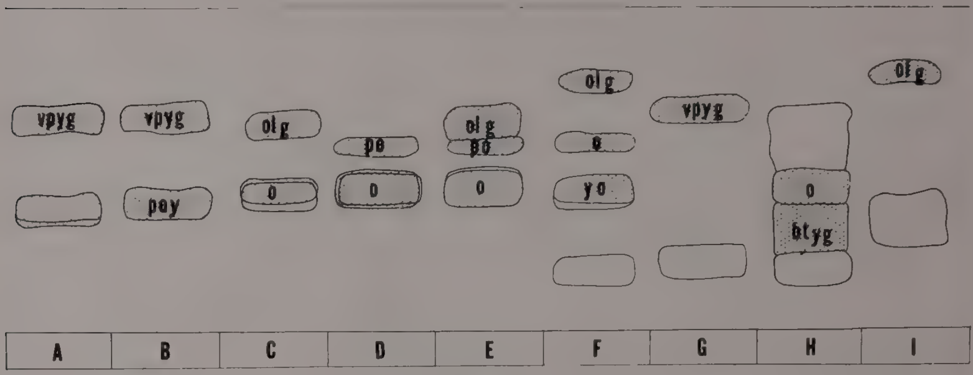

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FIGS. 333–334. Portions of chromatograms of flowers of *Cassia* spp. shown in FIG. 330 separated according to conditions employed in viewing, indicating colors displayed. FIG. 333. Spots and colors visible under UV with NH_3 vapor. Colors and qualities as with FIG. 331. FIG. 334. Spots and colors visible under UV without NH_3 vapor (stippled) and spots visible in daylight (unshaded). Owing to their paleness and overall similarity, colors are not indicated for the latter. Colors and qualities as with FIG. 331.

With regard to sectional relationships on the basis of chromatographic pattern, section *Xerocalyx* seems closer to section *Chamaecrista* than to *Absus*. However, closer evaluation of these interrelationships must be deferred until at least some of the substances involved are identified. For example, the upper anthocyanin band of L (*Chamaecrista*) appears in G and H (*Xerocalyx*), and the pale orange band (Rf ca. 15) in L may be the same as the similarly colored bands in G and H. While the significance of a common intersectional band may be slight, it must be ranked, at this preliminary stage, as equal to the significance of any single unidentified band.

The second series of tests was made with 8 taxa of section *Xerocalyx* and with *C. calycioides* DC. Of these, 4 had been tested previously in the broader survey described above. Treatment of this material differed slightly in that proprionic acid : water (20 : 80) was substituted for acetic acid. Patterns resulting from this treatment are shown in Fig. 330, and in Figs. 333 and 334.

The parallelisms noted previously in F, G, H, and I (Figs. 329, 331 and 332) are duplicated approximately in Fig. 330, 333 and 334. While I does not precisely match any of the other patterns, its affinity to them is clear. H is similar to I, although the prominent orange component is absent, as are a few others. A and B, while conforming to the ground pattern of the section, show the weakest relationship to it, but their similarity to each other is striking.

In the acetic acid: water solvent system the pattern displayed by J, *C. calycioides,* is undistinguished when compared with either *Xerocalyx* or *Chamaecrista.* Its only outstandingly different band is an orange-red one at low Rf. The high olive-green, which appears also in G, has been observed to be of general though sporadic occurrence elsewhere in the genus. With T-butanol : proprionic acid : water (3 : 1 : 1), J is somewhat better distinguished. A large rose spot, seen nowhere else, develops at low Rf, and several high bands common to 5 other taxa are lacking.

Thus, with the addition of 4 taxa in the section *Xerocalyx,* the basic pattern observed in the survey of 3 sections remains meaningful. Since the patterns shown by *C. calycioides* were only slightly distinguished from those displayed by taxa in either section *Xerocalyx* or section *Chamaecrista,* its position relative to these sections must be judged on other grounds. Chromatographically, *C. calycioides* appears rather intermediate to these sections.

It must be borne in mind that these preliminary biochemical studies represent mere scratches on the surface of a vast body of potentially useful information. Lacking more exact knowledge of the substances involved, it has been necessary to deal with class-determinations and to emphasize spatial relationships among chromatographed components. It is clear, however, that in general the genus *Cassia,* and in particular the section *Xerocalyx,* offer suitable material for detailed biochemical study.

SECTIONAL RELATIONSHIPS

As has been mentioned, the work of Bentham (1871) represents the last general revision of the subgeneric taxa of *Cassia.* Several attempts at reorganization have been made since, mainly by Britton and Rose (1930), who followed Rafinesque (1838) in part, but these were carried out with species in restricted areas and are, therefore, of little use in interpreting the overall currents of affinity coursing through the genus. In such treatments, frequent employment of single-character segregations resulted in separation of species which are obviously closely related. Perhaps no better example of this can be found than in Rafinesque's separation of *C. alata* L. and *C. reticulata* Willd. (included by Bentham in the very natural series *Pictae* of section *Chamaesenna*) to the genera *Herpetica* and *Chamaesenna,* respectively, a segregation retained by Britton and Rose. So similar are these species that without fruit or seeds it is very difficult to distinguish them.

It is obvious that where species and higher infrageneric taxa of wide distribution are involved, local revisions which do not consider more than a fraction of the total number of species in a genus tend very strongly to introduce elements of confusion into the overall taxonomy of that genus. Numerous genera, i.e. *Astragalus* (Jones, 1923), *Acacia* (Britton & Rose, 1930), *Mimosa* (ibid), and *Senecio* (ibid) have been extensively revised regionally, but, as with *Cassia,* without apparent regard for the systematic consequences on segments of the genera found outside of the geographical limits under study. Whatever the merit of a regionally delimited revision, it is at least in part a reflection of the external inapplicability of the revision that workers outside the area continue to deal with these genera in the broad sense.

With respect to *Cassia* it is evident that Bentham took cognizance of geographical data in constructing his morphologically distinguished infrageneric taxa. In a survey of chromosome numbers for the genus, Irwin and Turner (1960) found that chromosomal data tend to support the general scheme adopted by Bentham. However, in the section *Chamaecrista* it has become apparent through several lines of investigation that a considerable cleavage exists between the 2 subsections erected by Bentham. Characters determined for the section *Xerocalyx* are given in comparison with the same traits of other infrageneric taxa in Table II. *C. calycioides* and *C. aristellata* are treated separately, as before.

It is clear that the section *Xerocalyx* stands apart from section *Chamaecrista* on the bases of chromosome number, position of ridge bundles, leaflet venation, sepal venation, sepal inequality, and seed form. In addition, chromatographic tests show a pattern for the section which is quite distinct from that seen in any other section of the genus.

The clarity of this picture would be considerably marred if Bentham were followed to the extent that *C. calycioides,* and the closely related *C. aristellata,* were accepted within the section *Xerocalyx*. However, it is seen that these 2 species fall within the presently recognized limits of the section only with respect to certain sepal characters, their parallel venation and marginal anastomoses in particular. As has been stated, the first of these, together with the closely associated sepal rigidity, were the characters designated by Bentham as distinct for his subsection *Xerocalyx*. On the other hand, and as may be seen in Table II, in all the remaining traits listed above as distinct for section *Xerocalyx,* the affinities of *C. calycioides* and *C. aristellata* lie within section *Chamaecrista*. Chromatographic study of *C. calycioides* has yielded indifferent results, i.e. patterns which appear to neither confirm nor deny its inclusion in either section. Therefore, it is proposed that on the basis of all evidence now available *C. calycioides* and *C. aristellata* be transferred to section *Chamaecrista*. In this section they will probably be found relatively distinct, especially as regards the already mentioned sepal characters, perhaps justifying the erection of a new series.

It is because of the striking collective distinctness of the taxa which thus comprise *Xerocalyx* that sectional status is deemed appropriate. The total weight of the arguments favoring this shift in status is considered more impressive than those which are used to defend segregation of section *Oncolobium* from section *Chamaefistula,* or section *Psilorhegma* from section *Chamaesenna*.

Accordingly, the following section is proposed:

Cassia L., sect. **Xerocalyx** (Bentham) H. S. Irwin, sect. nov.

Cassia L., sect. *Chamaecrista* (Moench) Collad., subsect.
Xerocalyx Bentham. Trans. Linn. Soc. **27**: 568. 1871.

Herbs, subshrubs, and shrubs, glabrous or pubescent. Stipules usually persistent and appressed to stem, entire. Petiole or rachis terminally aristate or aristulate.

Leaflets 1–2-jugate, the visible veins parallel or divergent, the margins entire. Flowers axillary, solitary, or 2–4 in much-condensed racemes. Sepals acuminate, unequal, striate, multinerved. Petals yellow, the largest rarely partly or wholly red. Stamens yellow or straw-colored. Seeds narrowly pyriform, lachrymiform, or clavate, never trapezoidal, finely pitted in lines, hard, brown or black.

DISTRIBUTION AND ECOLOGY

The section *Xerocalyx* occupies a vast area from the latitude of the Tropic of Cancer in the West Indies and Mexico, southward to about 30° south latitude in the Brazilian state of Santa Catarina and the adjacent state of Misiones, Argentina. One species occurs in the West Indian islands of Cuba (including Isla de Pinos), Santo Domingo, Puerto Rico, and St. Christopher. With these exceptions the range of the section is probably continuous, although in some regions its occurrence is more presumptive than proven. Such questionable areas include the northern half of the Yucatán peninsula, the Darien region of Panama and adjacent Colombia west of the Cordillera Occidentale northeastward to Sierra de Santa Marta, much of the southern half of the Amazon drainage, and most of the Brazilian state of Bahia. No material has been seen from the upper Amazon valley west of 65° W longitude except for collections taken along the Rio Negro and its tributaries. Although this region is little explored, other equally little known regions are represented by at least a few collections. Therefore this region is omitted from the general distribution map given in Fig. 335.

Within the overall range of the section certain areas are more adequately represented than others. In general the material from Central America and the West Indies is rather scanty, but Puerto Rico, Western Cuba, Isla de Pinos, and British Honduras are notable exceptions. Similarly, large areas in the South American range are known by only a few isolated collections, but for certain regions good sets of specimens exist, among them: Central Colombia east of the Cordillera Central, Gran Sabana of Venezuela, north-central Surinam, vicinity of Santarém and Belém in the Amazon Valley, Serra do Espinaço (especially in Serra do Cipó and the vicinity of Diamantina) in south-central Brazil, and the coastal region near Rio de Janeiro. In some of these regions proximity to established travel routes has made collection relatively easy, but in others the adequacy of material is the result of the determined efforts of particular groups or individuals.

With regard to vertical range, members of the section are rarely found above 3000 feet in more extreme portions of its range, while a maximum of 5000 feet is known for the central equatorial portion, especially in the vicinity of Mount Roraima.

Most species are colonizers of savannas and low open wooden areas, nearly all showing a preference for loose sandy soil and intolerance of shade. The author has observed in northern South America, especially in British Guiana and adjacent Venezuela, that of the taxa most common there, i.e. *C. tetraphylla* Desv. var. *tetraphylla, C. ramosa* Vog. var. *ramosa,* and *C. cultrifolia* H.B.K., the first 2 reach their greatest development and frequency on the white quartz sand (i.e. the White Sand Series, Jenks et al., 1956) so widely distributed over the Guayana Shield, while the last is more common on grassy savannahs underlain with brown sandy clay. In the

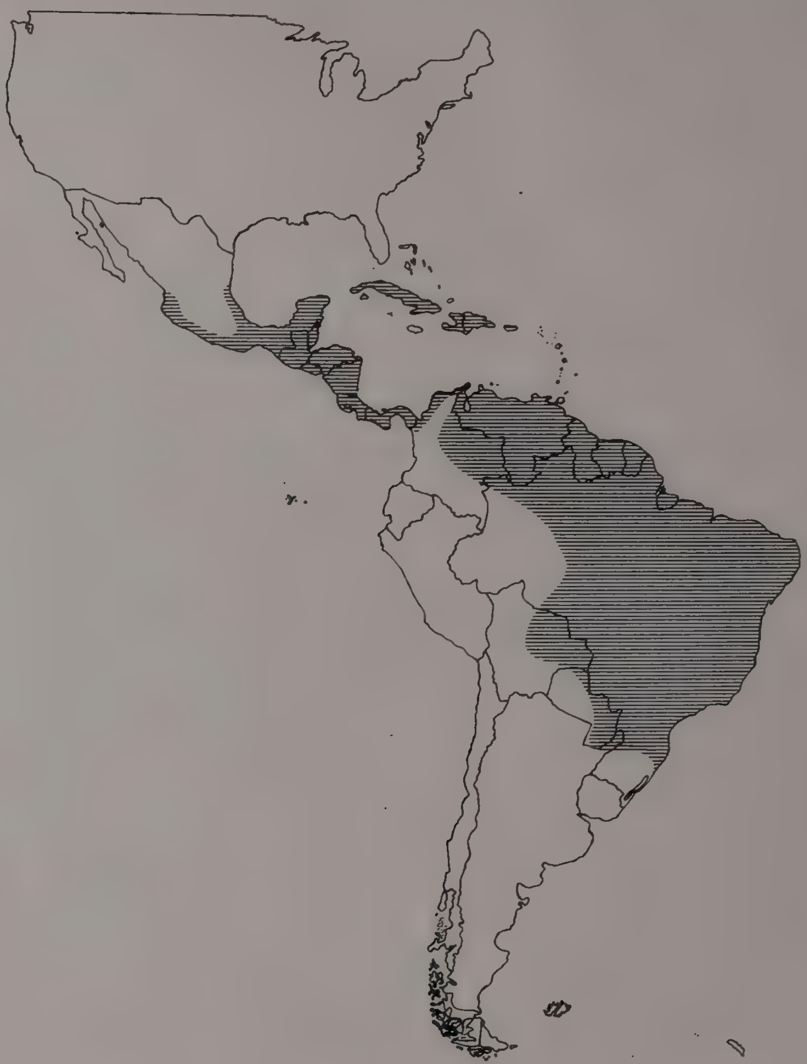

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FIG. 335. Map showing distribution of section *Xerocalyx*.

central portion of the Brazilian Shield, i.e. in south-central Brazil, the same preference by most taxa for sandy soils has been noted in the field, although some, e.g. *C. tetraphylla* Desv. var. *mollissima* (Benth.) Irwin and *C. langsdorffii* Kunth var. *langsdorffii,* occur not uncommonly on hard sandy clays.

Results of attempts at cultivation of several species suggest that the rather spotty local distribution of many species within their overall ranges may possibly be influenced in part by strict mineral requirements. Seeds of *C. tetraphylla* var. *tetraphylla* and *C. cultrifolia,* when germinated in the greenhouse in well washed littoral sand to which had been added ¼ volume of loam with an acidified 10 : 20 : 10 garden fertilizer, ceased growth at the first node. Somewhat better results were had when an untreated slightly acid yellow sandy soil (transported from Bastrop County, Texas) was used, but here growth attenuated after the fifth node, the plants becoming chlorotic and soon dying. Addition of chelated iron had no effect. In all cases distilled water was used.

SPECIFIC CONCEPTS

In the present paper the section *Xerocalyx* and its included units have been delimited by critical examination of data obtained through study of morphology, anatomy, cytology, biochemistry, and geographical distribution. An attempt has been made toward consistent treatment of taxa, but fragmentary information had in some cases impeded assessment of status. In a few instances certain populations have been designated as being potentially worthy of nomenclatural recognition; in such cases apparent affinities to recognized taxa are indicated. In general, the treatment accorded infrasectional taxa is conservative.

The overall homogeneity, which has been mentioned previously in connection with the status of the section, has in many cases made delimitation of species and varieties difficult. Certain taxa show great variability and merging of characters with other taxa, especially in south-central Brazil where the section appears to have its distributional center. Others, even in the same region, show remarkable stability, although in most instances this is related to narrow endemism and a greater or lesser degree of geographical isolation. It is evident that certain mechanisms operative within the section, most likely hybridization and back-crossing, have caused a great deal of this variation and intergradation. However, in the absence of populational and genetic data, this allusion cannot yet be made firmer. It is hoped that in the future, with more critical study of biological segregates, and no doubt the discovery of others yet unknown, a more complete circumscription will result. For the present, it is quite clear that if all biological entities were accorded nomenclatural status the treatment of the section would be neither morphologically consistent nor phyletically meaningful. If, at the other extreme, the guiding criterion for specific recognition were complete morphological discontinuity, the section might well have been regarded as monotypic. Such a view would, of course, be phyletically meaningless in that it would ignore patterns of variability resulting from extended natural selection.

Artificial Key to Species and Varieties of Section *Xerocalyx*

1. Leaflets 1 pair.
  2. Leaflets linear-oblong or oblong, often falcate, coriaceous, the margins hyaline; apical margins of stipules and leaflets ciliolate. 1. *C. cultrifolia.*
  2. Leaflets obovate to suborbicular, firmly membranaceous, not hyaline-margined; margins of stipules and leaflets not ciliolate, the stipules often ciliolate at the base. 2. *C. diphylla.*
1. Leaflets 2 pairs.
  3. Pedicels 1.0 cm long or longer, glabrous; petioles pubescent or glabrous.
    4. Stipules 1.5–3.3 cm long and 0.8–2.2 cm broad, apex rounded or obtuse; leaflets mostly 2.0–4.0 cm long; shrubs 1.5–4.0 m tall. 3. *C. latistipula.*

4. Stipules shorter, or if as long then the apex acute or acuminate; leaflets less than 2.5 cm long; herbs, subshrubs and shrubs mostly less than 1.5 m tall.

5. Stipules mostly caducous, or at least falling before the associated leaves; flowers 1.0–1.5 cm across; fruit 1.4–1.7 cm long. 4. *C. gracilis.*

5. Stipules persistent; flowers more than 2.0 cm across; fruit 2.0 cm long or longer.

6. Petiolar gland often spherical, elevated on a slender stipe 0.7–1.5 mm high.

7. Leaflets more than 1.1 cm long, glabrous.

8. Leaflets membranaceous, 4.0–8.0 mm broad; stipules broadly cordate-ovate. 5. *C. piribebuiensis.*

8. Leaflets coriaceous, 7.0–17.0 mm broad; stipules ovate to orbicular. 6. *C. piauhiensis.*

7. Leaflets less than 1.1 cm long, glabrous or puberulent.

9. Plant erect, of inland regions; petiolar gland 0.4–0.7 mm across. 9a. *C. ramosa* var. *ramosa.*

9. Plant decumbent or ascending, of littoral regions, the lower stems producing adventitious roots; petiolar gland 0.2–0.5 mm across. 9b. *C. ramosa* var. *maritima.*

6. Petiolar gland scutellate or urceolate, sessile or elevated on a thick stipe less than 0.7 mm high.

10. Stipules small, mostly less than 1.0 cm long, narrowly deltoid-lanceolate; proximal leaflets mostly shorter than the distal.

11. Stipules 2.0–3.5 mm long, 0.7–1.6 mm broad; pedicels 2.0–3.0 cm long. 7d. *C. langsdorffii* var. *tenuis.*

11. Stipules 3.5–8.0 mm long, 1.5–3.0 mm broad; pedicels mostly 0.4–2.0 cm long. 7e. *C. langsdorffii* var. *parvifoliola.*

10. Stipules large, 1.0 cm long or longer, broadly lanceolate to ovate; proximal leaflets equal to or longer than those of the distal pair.

12. Pedicels 3.0–5.2 cm long, ca. 0.5 mm thick; leaflets membranaceous. 7b. *C. langsdorffii* var. *longipedicellata.*

12. Pedicels 1.5–3.5 cm long, ca. 1 mm thick; leaflets subcoriaceous, hyaline-margined.

13. Petioles bristly-hairy beneath; proximal leaflets ovate, rounded at apex. 7c. *C. langsdorffii* var. *latifoliola.*

13. Petioles glabrous; proximal leaflets linear-lanceolate or lanceolate, acute to obtuse at apex. 7a. *C. langsdorffi* var. *langsdorffi.*

3. Pedicels variable in length, pubescent at least in a line; petioles pubescent (except in *C. curvifolia* var. *lucida*).

14. Leaflets firmly membranaceous, straight or divergent, or if falcate then the apex rounded or obtuse; bracteoles linear to lanceolate.

15. Petiolar gland flat or depressed or rounded, sessile or elevated not more than 0.5 mm on a thick stipe.

16. Pedicels flattened, pubescent on one face; petiolar gland depressed, often obscure, 0.4 mm or less broad.

17. Plant erect, to 1 m or more, simple or little branched at base, often widely branched above; stipules 6.0–9.0 mm long; bracteoles 3.9–5.1 mm long. 10a. *C. chartacea* var. *chartacea.*

17. Plant decumbent or suberect, less than 1.0 m tall, usually much branched from base; stipules 2.0–7.0 mm long; bracteoles 1.7–2.3 mm long. 10b. *C. chartacea* var. *tenuicaulis.*

16. Pedicels terete, or if flattened then pubescent throughout; petiolar gland evident, mostly broader than 0.4 mm.
  18. Plant gray-pubescent; stem-rooting to form extensive mats. 11. *C. malacophylla.*
  18. Plant glabrous, or pubescence if present not gray; erect to decumbent, if stem-rooting then not forming mats.
    19. Entire plant brownish- or yellowish-pubescent; stipules 1.0–1.9 cm long; corolla 2.5–3.5 cm across. 12. *C. tecta.*
    19. Plant glabrous, or if pubescent then the hairs not brownish or yellowish, the stipules less than 1 cm long, and the corolla more than 3.5 cm across.
      20. Plant often diffusely branched from near base; corolla 1.5–2.2 cm across; fruit mostly less than 2.5 cm long. 13. *C. saxatilis.*
      20. Plant mostly erect, at least below, or if branched at base then corolla 2.5 cm or more broad and fruit 2.5 cm or more long.
        21. Bracteoles ovate, ca. 1.5 times longer than broad.
          22. Pedicels and fruit copiously yellow-pilose, the hairs 1.0 mm long or longer. 14. *C. bartlettii.*
          22. Pedicels and fruit rather sparsely short-pubescent, the hairs mostly less than 0.5 mm long. 15. *C. madrensis.*
        21. Bracteoles lanceolate to narrowly ovate, more than 1.7 times longer than broad.
          23. Leaflets linear, ca. 8–10 times longer than broad. 16b. *C. tetraphylla* var. *linearis.*
          23. Leaflets lanceolate or broader.
            24. Pedicels less than 1.0 cm long, rarely longer.
              25. Stipules oblong, obtuse or broadly acute; distal leaflets divergent. 16c. *C. tetraphylla* var. *ventuarensis.*
              25. Stipules lanceolate to deltoid, acute or acuminate.
                26. Fruit yellow-hirsute, 2.0–2.5 times longer than broad. 16d. *C. tetraphylla* var. *aurivilla.*
                26. Fruit finely pubescent, 3 or more times longer than broad. 16e. *C. tetraphylla* var. *brevipes.*
            24. Pedicels more than 1.0 cm long.
              27. Leaflets velvety-pubescent. 16f. *C. tetraphylla* var. *mollissima.*
              27. Leaflets glabrous on faces, rarely puberulent or pubescent.
                28. Stipules lanceolate-oblong to deltoid, acute to acuminate (rounded in Surinam specimens). 16a. *C. tetraphylla* var. *tetraphylla.*
                28. Stipules broadly lanceolate to ovate, apex obtuse to short-acute or mucronate.
                  29. Pedicels and fruit margins short-pubescent; fruit faces often glabrate; plant of littoral regions. 16g. *C. tetraphylla* var. *littoralis.*
                  29. Pedicels and fruit yellow-pilose; plant of inland regions. 16h. *C. tetraphylla* var. *colombiana.*

15. Petiolar gland urceolate or globular, 0.7 mm or less in diameter, supported on a slender stipe 0.7–1.2 mm high.

30. Plant erect, of inland regions; petiolar gland 0.4–0.7 mm across.
9a. *C. ramosa* var. *ramosa.*
30. Plant decumbent or ascending, of littoral regions, the lower stems producing adventitious roots; petiolar gland 0.2–0.5 mm across.
9b. *C. ramosa* var. *maritima.*
14. Leaflets coriaceous, distinctly falcate, apiculate; bracteoles ovate.
  31. Leaflets velvety-pubescent.
  8b. *C. curvifolia* var. *mollissima.*
  31. Leaflets glabrous or sparsely puberulent.
    32. Leaflets mostly 8.0–17.0 mm long, 2.5–5.0 mm broad.
    8c. *C. curvifolia* var. *lucida.*
    32. Leaflets 3.0–8.0 mm long, 1.4–2.7 mm broad.
    8a. *C. curvifolia* var. *curvifolia.*

SYSTEMATIC TREATMENT

1. **Cassia cultrifolia** Humboldt, Bonpland & Kunth, Nov. Gen. et Sp. Pl. **6**: 363. 1823. Photographs of holotype (F, GH, NY, TEX) in Botanisches Museum, Berlin, examined: Venezuela, "Herb. Willdenow. Cumuna." Humboldt s.n. w/o date (collected in Venezuela, 1799–1800).

Chamaecrista cultrifolia (H.B.K.) Britt. & Rose, Ann. N. Y. Acad. **35**: 183. 1936.

Annual or short-lived perennial herb[11] with erect or ascending, simple or few-branched glabrous stems, usually less than 1 m tall. Stipules often obscuring the upper stem, lanceolate-cordate, acuminate, 1.0–2.5 cm long, 0.4–0.8 cm broad, marginally ciliolate on apical one-third and on basal auricles. Petiole 3.0–7.5 mm long, prolonged beyond nodule as an aristate appendage, the abaxial groove glabrous to pubescent, the abaxial surface strigose or hirsute with distally-directed hairs 0.5–1.5 mm long. Gland scutellate or urceolate, 0.5–1.0 mm broad, sessile or rising from the groove on a short thick stipe. Leaflets unijugate, each joined to petiole by an oblique, linear, black pulvinule, linear-oblong or oblong, oblique or falcate, glabrous, subcoriaceous, 1.5–3.5 cm long, 0.4–1.2 cm broad, usually rather pale gray- or yellow-green; margins hyaline, ciliolate on the apical one-third. Flowers usually solitary, produced in continuous succession except in periods of drought; pedicels commonly arching upward, pilose, 1.8–3.4 cm long and ca. 0.5 mm thick in flower, up to 4.2 cm long and 1.0 mm thick in fruit; bracts 1 or 2, apparently caducous, ovate or narrowly ovate, 1.5–2.5 mm long, ca. 1.0 mm broad; bracteoles subopposite, appressed, linear or linear-lanceolate, 1.5–2.5 mm long, 1.0–1.5 mm broad; sepals linear-lanceolate or lanceolate, glabrous, 1.0–1.5 cm long, 2.0–3.0 mm broad; petals 1.0–1.7 cm long, 0.6–1.2 cm broad; ovary pilose with appressed grayish hairs. Pod narrowly oblong, 3.5–5.0 cm long, 0.4–0.7 cm broad, the valves shallowly

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[11] The terms "annual" and "perennial" are here, as with many tropical herbs, quite meaningless. In this species growth continues more or less indefinitely without regard to seasonal variation in rainfall or temperature. Occasional lateral shoots arise from near the base as older ones decline in vigor. Death may result from fire (although several species in this section are fire-resistant), prolonged drought, or intense competition with other species. In British Guiana, where some plants were kept in cultivation, numerous individuals persisted for 4 years while others died at the onset of the first dry season.

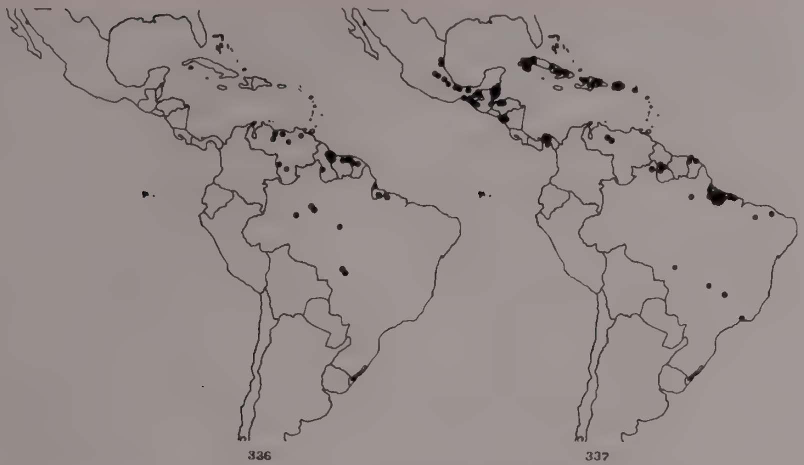

FIG. 336. Map showing distribution of *C. cultrifolia.* FIG. 337. Map showing distribution of *C. diphylla.*

sulcate between the seeds, appressed-puberulent to pilose. Seeds 15–20, slightly compressed, 3.5–5.0 mm long, 1.5–2.0 mm broad.

Chromosome number: $n = 7$.

Distribution: Venezuela and eastern Colombia, eastward through the Guianas to Amapá, Brazil, and southward through Rio Branco, Amazonas, and Pará to Mato Grosso and Goiás. Occurring in savannas and low open woods (i.e. "cerrado" in Brazil; "muri" in British Guiana); chiefly on sandy soils, at elevations usually less than 3000 feet, except in the region of the Pakaraima Mountains (British Guiana, Venezuela, Brazil) where occasional plants have been taken at ca. 4000 feet.

Cassia cultrifolia is one of the more stable taxa in the section *Xerocalyx,* showing relatively slight variability over the whole of its extensive range. The most marked variation is with regard to leaflet and stipule size and pedicel length, but these characters vary independently and present no meaningful regional patterns. Depauperate plants are often found on especially poor soils.

Unfortunately this species is not only rather inconspicuous, especially when not in flower, but also seems, in the present author's experience, nowhere common. It is not surprising, then, that herbarium material is rather scant, especially from the south drainage of the Amazon and the northeastern portion of Brazil south of Pará.

C. cultrifolia seems most closely related to *C. diphylla;* certain forms of the latter have narrow leaflets which superficially resemble those of *C. cultrifolia.* However, in the few localities where both species were observed in relative proximity, no evidence of hybridization was seen.

BRAZIL, AMAPA: Curiaú, Municipio de Macapá, 10 July 1951, *G A. Black* & *R. L. Fróes 51–12268* (SI). AMAZONAS: In campo non inundabili "Marajosinho" Rio Negro inferioris, 4 Apr. 1945, *A. Ducke 1698* (F,[12] GH, MG, NY); Rio Negro inferioris Bahia Boiassu, loco Campo Amelia, 23 Mar. 1941, *A. Ducke 20431* (SI). GOIAS: Porto Real, w/o date, *W. J. Burchell 8489* (K); Porto Real, w/o date, *W. J. Burchell 8598-2* (K); Porto Real, w/o date, *W. J. Burchell 8635-2* (K); Porto Real, w/o date, *W. J. Burchell 8679-17* (K); Porto Real, w/o date, *W. J. Burchell 8744-3* (K); 102 km. N.E. of Jandaia on road to Goiânia, 6 Feb. 1959, *H. S. Irwin 2589* (MICH, NY, R, TEX, UC, US, VIC). MARANHAO: Perto de Carolina. 26 May 1950, *J. M. Pires* & *G. A. Black 2157* (NY). MATO GROSSO: Arica near Cuyabá, 8 May 1903, *G. Malme s.n.* (S) ; Santa Anna da Chapada, 12 May 1903, *G. Malme s.n.* (S); Santa Anna da Chapada, 29 May 1903, *G. Malme s.n.* (S); Santa Anna da Chapada, w/o date, *Riedel 485* (K); Near source of Rio Paraguay (Rio Amolar), May 1927, *D. Smith 192* (K). PARA: Rio Camará, Pau Grande, Fazenda S. Rita, 8 July 1950, *G. A. Black 50-9976* (NY); Maracana, Campo Martins Pinheiro, alem da estrada Cuinarana, 20 June 1958, *P. Cavalcante 411* (MG); Montealegre, Sra. Itauajury, 25 Apr. 1926, *A. Ducke 16068* (MG); Alto Tapajós, Rio Cururú, Missão Velha, 20 July 1959, *W. A. Egler 985* (MG); Vigia, Campo do Caimbé, 26 Aug. 1959, *W. A. Egler 1066* (MG); Vigia, Campo do Caimbé, 26 Aug. 1959, *W. A. Egler 1066* (MG); Marajó, Jutuba, 1 July 1902, *J. Huber 2670* (MG). RIO BRANCO: Bôa Vista, campo de aviacão, 16 Aug. 1951, *G. A. Black 51-12617* (SI); Bôa Vista, campo em redor da cidade, 15 Aug. 1951, *G. A. Black 51-12533* (SI); Campo da Estrada Bôa Vista-Caracaraí, 2 Sept. 1951, *G. A. Black 51-13487* (SI).

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[12] The herbarium abbreviations used throughout this paper are in accordance with the recommendations of Lanjouw and Stafleu (1956).

BRITISH GUIANA: Humirida Mtns., 1863-1864, *C. Appun 1408* (K); Orealla Savannah, Corentyne R., Berbice, 6 Jan. 1955, *H. S. Irwin 617* (TEX); 4 mi. N. of Lethem, Essequibo, 17 Apr. 1956, *H. S. Irwin* 1021 (TEX); Orealla, Corentyne R., Sept. 1879, *G. S. Jenman 497* (K); Canje R., Apr. 1884, *G. S. Jenman 1859* (K); Waranama Ranch, Wiruni-Ituni Savannahs, Sept. 1929, *Martyn 113* (K); Berbice, 1837, *Robt. Schomburgk s.n.* (K); Berbice, 1837, *Robt. Schomburgk 401* (BM, F, K, NY); Roraima, 1842-1843, *Robert Schomburgk 721* (BM, NY).

COLOMBIA: Esmeralda, Río Casanare, Los Llanos, 19-20 Oct. 1938, *J. Cuatrecasas 3813a* (US) ; w/o locality, 1760-1808, *J. C. Mutis 4277* (NY, US).

FRENCH GUIANA: Cayenne, Apr. 1946, *P. Béna* 2386 (U); Maroni, w/o date, *M. Mélinon* 18 (US); w/o locality, 1842, *M. Mélinon s.n.* (BM).

SURINAM: Ad onoribo, w/o date, *Focke 866* (U); Ad R. Casawinica, June 1846, *Kappl. 1926* (U); Powakka Savanne, Sept. 1936, *Frickers* & *Muller 1* (U); Poika savanne, Saramacca, 17 May 1915, *Gonggrijp 6* (NY, U) ; Tibiti savanne, 5 Jan. 1949, *J. Lanjouw* & *J. C. Lindeman 1596* (U) ; Tibiti savanne, 5 Jan. 1949, *J. Lanjouw* & *J. C. Lindeman* 1605 (NY, U) ; Zanderij I, Savannah B, 10 Mar. 1949, *J. Lanjouw* & *J. C. Lindeman 3273* (NY, U) .

VENEZUELA: Sta. Isabel, Bolívar, 1942, *F. Cárdona* 630 (US); L'Orenoque, w/o date, *M. Chaffenjon s.n.* (P); Caraccas, w/o date, *Lockhart s.n.* (K); West from Santa Barbara for about 5 km., Río Orinoco and Río Ventuari junction, Amazonas, 23 Feb. 1951, *B. Maguire, R. S. Cowan,* & *J. J. Wurdack 32071-A* (NY); Hills of Prebo, Vic. of Valencia, 17 Jan. 1920, *H. Pittier 9425* (NY, US); Sabanas de Taguanes, Sept. 1942, *J. Saer d'Heguert 914* (NY, US); w/o locality, 1868, *E. P. Stevens s.n.* (NY); Savanna bei Entrada, 23 Dec. 1891, *Warming 1* (US); La Paragua, Bolívar, 6 Mar. 1940, *L. Williams 12608a* (US); Near Laguna Grande just south of L. Pica, La Hormiga Area, between La Pica and Cano Colorado east of Maturin, Monagas, 3 Oct. 1955, *J. J. Wurdack* & *J. V. Monachino 39548* (NY).

2. **Cassia diphylla** Linnaeus, Sp. Pl. p. 537. 1753. Photograph of holotype (NY) in Linnaean Herbarium examined.

Chamaecrista diphylla (L.) Greene, Pittonia 4: 28. 1899.

Cassia pentardria Larrañaga (probably a typographical error for "pentandria"), Escritos de Don Damaso Antonio Larrañaga 1: 408. 1922. Type specimen not indicated by Larrañaga, who, however, likened his Uruguayan plant, no doubt an introduction, to Cavanille's figure of *"C. diphylla,"* which is *C. diphylla* L.

Annual or short-lived perennial herb, usually with numerous prostrate to erect branches, to 1 m tall. Stipules partially obscuring upper stem, cordate-lanceolate, sometimes auriculate and often ciliolate at base, acuminate, 1.0–2.5 cm long, 0.4–0.8 cm broad. Petiole 3.0–8.0 mm long, the adaxial groove glabrous or pubescent, the abaxial surface glabrous or with a few long distally-directed hairs, rarely pilose. Gland 1, or if 2 the more distal larger, urceolate, ca. 0.5 mm broad, sessile or on a short slender stipe. Leaflets unijugate, joined to petiole by an oblique linear or arcuate black, pulvinule, usually obovate but varying from oblong-falcate to suborbicular, oblique, glabrous, membranaceous or rarely subcoriaceous, 1.0–3.5 cm long, 0.5–1.8 cm broad, pale to deep green; margins often apically undulate. Flowers usually solitary, produced more or less continuously; pedicels straight or arching upward, glabrous to pubescent or pilose, 1.2–3.5 cm long and ca. 0.5 mm thick in flower, up to 5.8 cm long and 1.2 mm thick in fruit; bracts 1 or 2, lanceolate to avte, 1.5–2.0 mm long, 0.7–1.3 mm broad; bracteoles subopposite or rather remote, appressed, linear or linear-lanceolate, 2.2–3.5 mm long, 0.8–1.5 mm broad; sepals linear-lanceolate, glabrous, 0.8–1.3 cm long, 2.0–3.0 mm broad; petals shorter than or equalling the sepals; ovary pubescent with appressed grayish or brownish hairs. Pod linear-oblong, straight or somewhat declined, often more or less sulcate between the seeds, appressed-puberulent to rather copiously and loosely pilose, 2.5–4.5 cm long, 0.5–0.7 cm broad. Seeds 15–20, slightly flattened, often curved, 3.5–5.5 mm long, 1.5–2.2 mm broad.

Chromosome number: $n = 7$.

Distribution: Mexico and the West Indian islands of Cuba (including Isla de Pinos), Hispaniola, Puerto Rico, and St. Christopher, southward through Central America to (Colombia?) Venezuela, the Guianas, and Pará, Brazil, and more sparingly southward through Ceará, Mato Grosso, Goiás, and Minas Gerais to Rio de Janeiro. Occurring mainly in savannas, open woods, and ruderal situations, most commonly on white sand, from sea level to elevations of less than 3000 feet.

Cassia diphylla is perhaps the only member of the section *Xerocalyx* which may be termed a ruderal weed. In general, it has been found most abundantly in disturbed regions, particularly in cut-over woods, pastures, and cultivations in eastern Mexico, the larger West Indian islands, and in the Amazon delta. A secondary habitat preference is littoral dunes, mainly in the more northerly half of its range, but where, however, maritime selection, if any, has resulted in no distinguishing features.

Although this species exhibits considerable variation in habit and details of leaf and stipule dimension, pedicel pubescence, and petal size, there seems to be no pattern evident between any of these variables and habitat or region. Perhaps the most striking are specimens with broad, nearly orbicular leaflets, but these have been taken at widely separated stations in a variety of habitats in British Guiana, French Guiana, Pernambuco, and elsewhere. In this species subcoriaceous leaflets are related to reduction in leaflet width, a pair of characters occasionally met with in specimens from southern Mexico, Republic of Honduras, and Panama. Pedicels tend to be either glabrous *or* pubescent, but both conditions are known almost throughout the range of this species and without relationship to other characters.

The type locality for *C. diphylla* is unknown, Linnaeus' designation "habitat in India" being erroneous, incomplete (i.e. for "India occidentalis"), or, less likely, based on an introduced plant. The only Old World specimen seen by the present author, *Merrill 8625* from Luzon, undoubtedly represents an introduction, probably as a result of inadvertant transport by commercial means. It is suspected that numerous collections from more populated regions in the New World, as that of Larrañaga cited above, are also from introduced plants.

BRAZIL, CEARA: Near Lagôa Tanape, Bairro de Bemfica, Fortaleza, 12 Aug. 1935, *F. Drouet 2229* (F, GH); S. Benedicto, 14 Oct. 1909, *A. Lisbôa 2416* (MG); Lussuanhã (?), 18 Mar. 1910, *A. Löfgren* 338 (S). GOIAS: Porto Real, w/o date, *W. J. Burchell 8645* (K); Porto Real, w/o date, *W. J. Burchell 8686-2* (K); w/o locality, 1841, *Gardner 3687* (K). MARANHAO: Campo do Cusins, Maracassumé River region, 8 Sept. 1932, *R. Fróes 1878* (BM, F, MICH, MO, NY, U, US); Seashore, Maranham, June 1841, *Gardner 6004* (BM, K, NY): Ilha Mongunça, July 1914, *A. Lisbôa 4754* (U). MATO GROSSO: In arenosis humidis Cujabá, w/o date, *Riedel 488* (K) . MINAS GERAIS: 12 km W of Araxá on road to Ibitrimirim, 31 Jan. 1959, *H. S. Irwin 2516* (MICH, NY, R, TEX, UC, US, VIC). PARA: Northeast woods of Instituto Agronomico do Norte, Belém, 30 Oct. 1942, *W. A. Archer 7752* (F, NY, US) ; North woods of Instituto Agronômico do Norte, Belém, 14 Mar. 1943, *W. A. Archer 8299* (US) ; Belém, 15 June 1944, *J. T. Baldwin Jr. 4519* (F. NY, US) ; Perizes, 5 July 1954, *G. L. Black, J. M. Pires, & D. Lima 54–16402* (NY) ; Marapanim, Práia de Marudasinho, 2 July 1958, *P. Cavalcante 425* (MG) ; Belém, Mar–May 1929, *B. E. Dahlgren & E. Sella 262* (NY, US) ; km S of Estrella do Norte, Município de Belém, 15 July 1935, *F. Drouet 2062* (F, GH, MICH, NY, S, US) ; Fazenda do Goivinho, Marajó, Nov. 1919, *A. Goeldi 3497* (BM, GH, NY, US) ; Marajó campos de Cachoeira, 1 July 1896,*J. Huber 194* (MG) ; Pará, State of Pará, 27 Oct–7 Nov. 1929, *E. P. Killip & A. C. Smith 30243* (GH, NY, US) ; Entrocamente nahe Belém, 18 June 1923, *E. H. Snethlage 85* (F, US) ; In vicinibus Pará, July–Aug. 1849, *R. Spruce s.n.* (BM, NY) . PERNAMBUCO: Tapera, Aug. 1930, *D. B. Pickel 30* (BM, F, GH, SI, US) ; Tapera, Aug. 1931, *D. B. Pickel s.n.* (F, MICH, US). RIO BRANCO: Surumú, Sept. 1909, *E. Ule 8136* (K, MG, UC). RIO DE JANEIRO: Restinga de Cabo Frio, 1879, *A. Glaziou 10569* (S).

BRITISH GUIANA: Sand Creek, Rupununi R., Oct. 1948, *Forest Dept. WB 289* (NY); Horroobea Savannah, April 1887, *G. S. Jenman 3745* (K); Rocks of Aripara on the Essequibo and Savannahs on the Upper Rupununi, *Robt. Schomburgk 21* (BM, K).

BRITISH HONDURAS: Pine ridge N of aviation field, Belize, 29 Jan. 1931, *H. H. Bartlett 11226* (MICH); Pine ridge N of aviation field, Belize, 29 Jan. 1931, *H. H. Bartlett 11251* (MICH, NY); Maskall Pine Ridge, Dec. 1933, *P. Gentle 954* (MICH, MO, NY, S); Maskall Pine Ridge, Dec. 1933, *P. Gentle* 969 (MICH,NY); Monkey River, 30 Aug. 1941, *P. H. Gentle 3629* (MICH, MO, NY); Pine Ridge Pasture, Iguana Creek Forest Reserve, Cayo District, 7 Feb. 1948, *A. F. A. Lamb 150* (K); Honey Camp, Sept. 1929, *C. L. Lundell 532* (GH, MO, NY, S); Honey Camp, 11 Aug. 1929, *C. L. Lundell* 683 (GH, MO, NY, UC); w/o locality, Nov. (?) 1883, *D. Morret* (?) s.n. (K); All Pines, 25 Aug. 1930, *W. A. Schipp 594* (BM, GH, MICH, MO, NY, S, UC).

CUBA: Vicinity of Siguanea, Isle of Pines, 15 Feb.–6 Mar. 1916, *N. L. Britton, E. G. Britton & P. Wilson 15236* (F, MO, NY); Near Nueva Gerona, Isla de Pinos, 15 Dec. 1903, *A. H. Curtiss 229* (F, GH, MO, NY); Galbis, Oriente, 13 Aug. 1916, *E. L. Ekman 7439* (F, S, UC); Bio (near Alto Cedro), Oriente, 26 Oct. 1919, *E. L. Ekman 10043* (GH, S); Sierra de los Organos, San Diego de Tapias, Pinar del Río, 23 April 1920, *E. L. Ekman 10653* (BM, S); between McKinley and Santa Barbara, 4 Dec. 1956, *E. P. Killip 45782* (SI); Garza, Sta. Clara, 25 Aug. 1909, *Bro. León 1296* (NY); Way to La Palma, San Diego de los Banos, Pinar del Río, 21 Aug. 1914, *Bro. León 4474* (NY); Southern foot of Cajalbana, Pinar del Río, 6 April 1915, *Bros. León & Charles 4911* (NY); Savanna west of Manacas, Sta. Clara, 27 Dec. 1916, *Bro. León & F. R. Cazanas 5875* (NY); Mountains near El Guama, Pinar del Río, 24 Mar. 1900, *W. Palmer & J. H. Riley 395* (NY); Isle of Pines, 29-31 Dec. 1901, *W. W.*

Rowlee 123 (F, MO, NY) ; Palm-barrens west of Guane, Pinar del Río, 21-22 Nov. 1911, *J. A. Shafer 10405* (F, MO, NY); Herradura, Pinar del Río, 11 Sept. 1905, *Van Hermann 869* (F, NY); Along Camino Aguacate from Bahia Honda to Banos Aguacate, Pinar del Río, 11–12 Dec. 1910, *P. Wilson 9216* (NY); San Cristobal, 1860–64, *C. Wright 2373* (BM, MO, NY, S, UC).

DOMINICAN REPUBLIC: Cotuy, Provincia de la Vega, 28 Jan–7 Feb. 1921, *W. L. Abbott 730* (NY); Vicinity of Piedra Blanca, Vega, 19 Dec. 1945, *H. A. Allard 14196* (MO, NY, S) ; Between Bonao and La Vega, Cordillera Central, Prov. de la Vega, 2 April 1926, *E. L. Ekman 5830* (S); Sabana de la Mar, Cordillera Central, Prov. de Lamaná, 9 July 1930, *E. L. Ekman 15606* (NY, S); Between Bayaguana and Guerra, prov. Trujillo, 19 Oct. 1946, *R. A. & E. S. Howard 9536* (GH, NY, S); Between Bayaguana and Guerra, Prov. Trujillo, 8 Nov. 1946, *R. A. & E. S. Howard 9907* (NY, S).

FRENCH GUIANA: Along road toward Cayenne, ca. 15 km from St. Laurent, 20 Dec. 1954, *R. S. Cowan 38927* (F, NY, US); w/o locality (Guyane Francaise), 1838, *J. B. Le Prieur s.n.* (K) ; Cayenne, w/o date, *J. Martin s.n.* (K) ; Mana, w/o date, *M. Mélinon s.n.* (F, GH, NY); Cayenne, w/o date, *Rohr s.n.* (BM); Mana, 1857, *P. A. Sagot 180* (BM, P, S).

GUATEMALA: Retalulen, 186–?, *Bernoulli & Cario 74* (?) (K) ; w/o locality (Guatemala), w/o date, *Friedrichsthal s.n.* (K); Los Amates, Dept. Izabal, 15 Feb. 1908, *W. A. Kellerman 7604* (NY).

HAITI: Massif du Nord, Mt. Organisé, 31 May 1926, *E. L. Ekman 6228* (F, S).

HONDURAS: Entre San Antonio del Mico y La Estancia, Río Cobré, Dept. of Morazán, 29 Sept. 1948, *A. Molina R. 1167* (GH); Vicinity of El Zamorano, 26 Nov. 1946–Jan. 9, 1947, *P. C. Standley 853* (F).

MEXICO: Cordillera, Vera Cruz, June–Oct. 1840, *H. Galeotti 3292* (K); 3 mi. N. of Tampico, Hy. 100, Tamaulipas, 31 Aug. 1957, *H. S. Irwin 1390* (TEX) ; Tabasco, w/o date, *E. P. Johnson s.n.* (NY); Mirador, Vera Cruz, July 1838, *J. Linden 713* (K); Las Garzas, Acapet., Chiapas, 4–7 June 1938, *E. Matuda 2740* (MICH, NY); Achotal, Balancan, Tabasco, 9–14 May 1939, *E. Matuda 3051* (F, MICH, NY); Ojo'Agua, Balancan, Tabasco, 9–14 May, 1939, *E. Matuda 3122* (MICH); Aguacate, Palenque, Chiapas, 16–18 July 1939, *E. Matuda 3797* (F, GH, MICH, NY); Zacuapan, Vera Cruz, June–Aug. 1906, *C. A. Purpus 1881* (BM, F, GH, MO, NY, UC); Zacuapan, Vera Cruz, May 1934, *C. A. Purpus 16226* (F); w/o locality (Plantae Novae Hispaniae), 1787–1795–1804, *Sessé, Mociño, Castillo, & Maldonado 2019* (BM, F); Minatitlan, 23 Aug. 1913, *J. Smith 411* (MO).

NICARAGUA: Realejo, Jan. (?) 1839, *Barclay 2748* (BM, F); Realejo, 1842, *Hinds* (Voyage of the Sulphur) *s.n.* (K); El Viejo, 1851, *Oersted "Cassia 13"* (K); Realejo, 1851, *Oersted "Cassia 16"* (K); Prope Lapoa, w/o date, *Oersted 10298* (":no:18:") (BM); Realejo, 1845–48, *Oersted 4955* (F); Monte El Viejo, 1845–48, *Oersted 4994* (F).

PANAMA: Taboga Island, 24 Jan. 1935, *P. H. Allen 109* (MO); Cocle, 12 Sept. 1938, *P. H. Allen 815* (GH, MO, NY); R. Azote Caballo, 7 Dec. 1934, *C. W. Dodge, J. A. Steyermark, & H. H. Allen 16845* (UC, U, GH); San José Island, Perlas archipelago, 16 Oct. 1944, *I. M. Johnston 183* (BM, GH, MO, U) ; Savana de Alhajuela, Chagres Valley, 12-15 May 1911, *H. Pittier 2391* (F, GH, NY); Isla de Taboga, w/o date, *Seemann 1035* (BM, K).

PHILIPPINES: Lamao, Bataan, Luzon, Jan. 1913, *E. D. Merrill 8625* (US).

PUERTO RICO: Sabana Abajo, 18 Jan. 1929, *N. L. Britton & E. G. Britton 9157* (F, NY); Vicinity of Vega Baja, 24 Mar. 1922, *N. L. Britton, E. G. Britton, & M. S. Brown 6752* (F, NY); Laguna Tortuguero, 5 Feb. 1915, *N. L. Britton, J. F. Cowell, & M. S. Brown 3838* (NY); Lecheria, on Río Piedras R. R., 7 Nov. 1899, *G. P. Goll, O. F. Cook, & G. N. Collins 9* (NY) ; Catario, 30 Nov. 1899, *G. P. Goll, O. F. Cook, & G. N. Collins 838* (NY) ; Santurce, Jan. 1899, *A. A. Heller 20* (F, NY); Santurce, 7 Jan. 1903, *A. A. Heller 6367* (F, MO, NY); Río Piedras, 30 Nov. 1911, *J. R. Johnston 54* (NY); Santurce, 10 Jan. 1899, *C. F. Millspaugh 291* (F, NY); Santurce, 5 Dec. 1937, *J. I. Otero 317* (MO); Aguada, in campis ad "Piedra Blanca," 18 Dec. 1886, *P. Sintenis 5708* (BM, F, MO, NY, S, SI, UG); Humacao, in declivibus ad "Buenavista," 29 Sept. 1886, *P. Sintenis 5784* (F, GH, MO, NY, S, UC); Manati, 14 June–22 July 1901, *L. M. Underwood* & *R. F. Griggs, s.n.* (NY).

ST. KITTS: w/o locality, (Insula St. Christopher) w/o date, *Fr. Mafron s.n.* (BM).

SURINAM: Zandsavana ad Post Oranje, Oct. 1862, *Focke 676* (U).

VENEZUELA: La Rubiera near Calabozo, Guarico, 1925, *M. Grisel 5* (US); Carratera Calabozo-Camaguan, Guarico, Aug. 1957, *M. Ramia 1281* (US).

3. **Cassia latistipula** Bentham, *in* Mart. Fl. Bras. XV (II): 156–157. 1870. Isotype examined (K): Brazil, Minas Gerais, "in locis humidis graminosis, pr. Riacho Fundo." *Riedel 570.* 1824–1825.

Cassia latistipula Bent. var. *glauca* Hassl., in Fedde Rep. Sp. Nov. 8: 129. 1910. Isotype examined (K): Paraguay, "in altaplanitie et declivibus Sierra de Amambay." *Hassler 10080.* 27 July 1910.

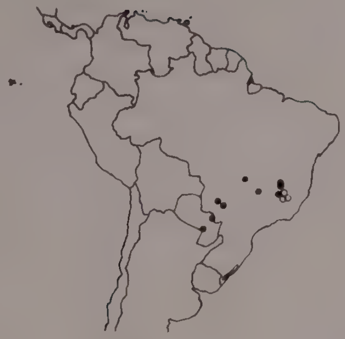
Cassia arlindo-andradei Hoehne, Arq. Bot. Est. S. Paulo, n. ser. form. Maior 2: 16. 1944. Isotype examined (SP): "Brasil-Estado de Mato Grosso: Campo Grande (sementes coletadas por F. C. Hoehne & A. Gehrt). Cultivada no Jardim Botânico de São Paulo, fl. & fr. 30/XI/1937—Arbusto de 1–2 m de altura, flores amarelas." *Handro 39070.*

Erect shrub or subshrub to 4 m tall, 3–7 cm in diameter at base, simple or sparsely virgate-branched. Stipules large, foliaceous, obscuring upper stem, broadly ovate to nearly orbicular, rounded at apex, 1.5–3.3 cm long, 0.8–2.2 cm broad, glabrous, often glaucous. Petiole 0.7–1.2 cm long, the adaxial groove glabrous, the abaxial surface glabrous or sparsely pilose with distally-directed hairs 1.0–1.5 mm long; rachis 0.5 to 0.7 as long as the petiole, terminally aristate. Glands 1 or 2, subequal, scutellate or shallowly urceolate, 0.5–1.0 mm broad, sessile or on a short slender stipe. Leaflets bijugate, the pairs equal or the inferior larger, joined to rachis by a small arcuate black pulvinule, oblong-obovate, oblique (at least at the base), glabrous, often glaucous (especially when young), firmly membranaceous, 1.5–4.1 cm long; 0.9–2.3 cm broad, yellow- or gray-green; margins often apically undulate. Flowers solitary or in pairs, produced in continuous succession; pedicels straight or arching upward, glabrous, 2.2–3.0 cm long and ca. 0.7 mm thick in flower, up to 5.4 cm long and 1.5 mm thick in fruit; bracts usually 2, ovate, 2.0–2.7 mm long, 0.8–1.4 mm broad; bracteoles subopposite, ovate, 4.0–6.2 mm long, 2.0–3.0 mm broad; sepals lanceolate or broadly lanceolate, glabrous, 1.0–1.7 cm long, 0.4–0.6 cm broad; petals 1.3–1.9 cm long, 0.7–1.4 cm broad; ovary pale to deep violet-brown, glabrous or grayish-yellow pilose on sutures or generally. Pod narrowly oblong. 3.5–7.0 cm long, 0.6–0.9 cm broad, faces usually slightly cristate over seeds, glabrous to sparsely pilose, sutures glabrous to densely pilose. Seeds 14–22, slightly compressed, 4.0-6.0 mm long, 1.5–2.2 mm broad.

Chromosome number: $n = 7$

Distribution: central and western Minas Gerais, southern Goiás, and southern Mato Grosso, Brazil, and adjacent Paraguay and northern Argentina. Occurring principally in damp situations, most often in mountainous districts, from 1000–3000 feet elevation.

Cassia latistipula, the largest species in the section *Xerocalyx,* shows considerable variation in two characters: glaucescence of stipules and leaflets, and pubescence of the fruit. The type is a young branch with immature leaves, a single flower, and a single detached fruit. The leaves and stipules show no glaucescence and the fruit no



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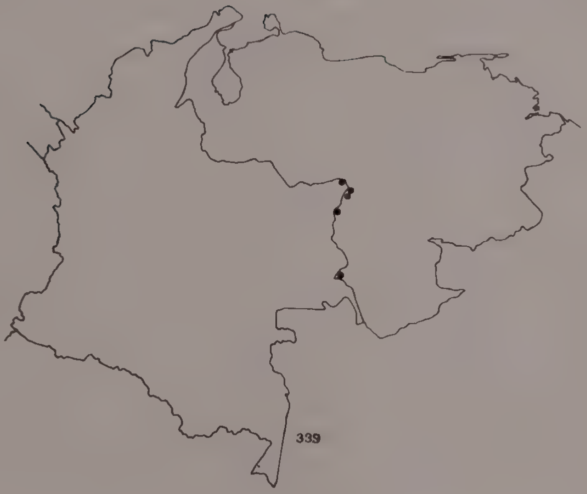

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FIG. 338. Map showing distribution of *C. latistipula*. Closed circles represent collections of morphologically typical specimens. Open circles represent collections which morphologically approach *C. langsdorffii*. FIG. 339. Map of Colombia and Venezuela showing distribution of *C. gracilis*.

pubescence. It was presumably with these characters in mind that Hassler described the variety *glauca* from specimens with copious bloom on leaflets, stipules, and pods, and Hoehne the species *C. arlindo-andradei* from material which, in addition to being glaucous, has marginally pubescent pods. However, in surveying the admittedly scant material which has been collected of *C. latistipula* and in light of the present author's field observations in Brazil, it is felt that this species must be regarded in the broad sense. The degree of glaucescence ranges from apparent absence in the type, as well as in several other collections from Minas Gerais and Goiás, to faint or transitory presence in *Lindeman A2673* (Mato Grosso), *Glaziou 20993* (Goiás), *Irwin 2359* (Minas Gerais), and *Hicken 243* (Corrientes, Argentina), and finally to strong, conspicuous presence in *Hassler 10080* (Paraguay), *Handro 39050* (Mato Grosso), and *Divers 24* (Paraguay). However, in each of these 3 categories (i.e. absence, faint presence, and strong presence of foliar glaucescence), pods vary from glabrous to pubescent. Thus, it is clear from the material at hand that these 2 characters vary independently, and while the former may in some degree be related to geography, the latter may not. Moreover, degree of glaucescence has been observed to vary according to habitat conditions. *Irwin 2359,* consisting of a number of small plants taken both in partial shade and full sun, illustrates the point well in that it collectively shows material that is lightly glaucescent (full sun) and aglaucescent (partial shade). Thus, in view of the apparent environmental influence on the expression of glaucescence and the very variable expression of pod pubescence, it seems best to treat all the known variants as a single species.

C. latistipula is probably most closely related to *C. langsdorffii* Kunth in that it exhibits the long stipules, large fruit, and broad bracteoles characteristic of the latter taxon. Some material from the mountainous region of central Minas Gerais, e.g. *Claussen 873* (NY, S) ; "Brésil (Minis-Geraes) ," and *Claussen* & *Delessert 21* (K) : "Caxoeiras do Campos, Minas Geraes," has markedly narrower and more strongly nerved leaflets; shorter, stouter pedicels; smaller, less persistent stipules; and a broad, stoutly stipitate petiolar gland, all suggestive of hybridization with *C. langsdorffii* var. *langsdorffii*. These 2 taxa are sympatric in central Minas Gerais and elsewhere. However, the majority of the material seen both in the field and as herbarium specimens is sufficiently distinct, especially in stature, stipule breadth, and leaflet shape and texture, to warrant specific rank.

ARGENTINA, CORRIENTES: Ituzaingo, 8 Feb. 1900, *Hicken 243* (SI) .

BRAZIL, GOIAS: Près du Rio dos Couros, 18 June 1894 (?), *Glaziou 20992* (K, P); Rio dos Couros et Nestre D'Armas, w/o date, *Glaziou 20993* (K, S). MINAS GERAIS: Serra do Curral, Minicipio Belo Horizonte, 2 Jan. 1959, *H. S. Irwin 2359* (MICH, NY, R, TEX, UC, US, VIC); Uberava, 29 Nov. 1848, *Regnell III 486,* (s); In montosis ad rivulas, Jan. 1824, *Riedel 1375* (US) ; W/o locality, w/o date, *Claussen s.n.*[13] (K,S) ;Caxoeiras do Campos, 1839, *Claussen 21* & *Delessert*[13] (K) ; W/o locality, w/o date, *Claussen 873* [13] (NY, S) . MATO GROSSO: São José, in campis apricis, 30 Dec. 1893, *C. A. M. Lindman A2673* (S). SAO PAULO: Campos de Butantá, 24 Mar. 1947, *J. D. Vedove* & *A. B. Joly 392ABJ* (SI).

PARAGUAY: Assumptione, Serra del Pays, June 1858, *Divers 24* (K); Sierra de Amambay, Jan. 1908 (?), *E. Hassler 10080* (P).

4. **Cassia gracilis** Kunth, Mimos. 120, t. 36. 1819. Photograph of figure (t.36) examined (NY) : Venezuela, "Orinoco River near San Borja." The illustration depicts all salient characters except mature fruit. The type specimen, presumably a collection of Humboldt, could not be found.

Chamaecrista gracilis (Kunth) Pittier, 3rd Conf. Interam. Agric. Caracas: 373. 1945.

Erect slender shrub or subshrub, simple at base, much branched above, to 0.6 m tall. Stems smooth, glabrous, dark violet-brown. Stipules usually caducous, seldom persisting below third node, minute, lanceolate or broadly lanceolate, acuminate, 2.0–2.8 mm long, 0.7–1.4 mm broad, sessile or slightly elevated. Leaflets bijugate, the inferior pair usually longer, sessile by a minute arcuate pulvinule, obovate-oblong, obtuse or rounded, oblique or falcate, glabrous, membranaceous, 0.6–1.2 cm long, 0.2–0.4 cm broad, venation indistinct. Flowers solitary or in pairs, produced more or less continuously; pedicels filiform, usually straight, glabrous or rarely sparsely puberulent in a line, 1.2–2.0 cm long in flower, up to 2.7 cm long in fruit; bracts 1 or 2, caducous, triangular, 0.5–0.7 mm long, 0.3–0.5 mm broad; bracteoles remote, appressed, persistent, linear or linear-lanceolate, 1.0–1.4 mm long, 0.3–0.5 mm broad; sepals lanceolate, glabrous, 0.5–0.7 cm long, 1.5–2.5 mm broad; petals 0.5–0.7 cm long, 0.4–0.6 cm broad; ovary pubescent with appressed grayish hairs. Pod oblong to obovate, 1.4–1.7 cm long (exclusive of the often persistent style) , 0.4–0.6 cm broad, valves slightly cristate over seeds, glabrous or very sparingly appressed-pubescent. Seeds 4–6, flattened, 3.5–4.5 mm long, 1.7–2.2 mm broad.

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[13] Specimens intermediate between *C. latistipula* and *C. langsdorffii*.

Chromosome number: not determined.

Distribution: Colombia and Venezuela along the upper Orinoco River, between the tributaries Río Aripe and Río Ventuari. Occurring in savannas on sandy soils and crystalline outcrops.

Although DeCandolle (1825) and Vogel (1837) followed Kunth's circumscription of *C. gracilis,* Bentham (*in* Martius, 1870) broadened the concept of this species to include the superficially similar *Pohl 906* (F, K): "Serra da Chrystaes", from Goiás. In addition, Martius described var. *erythrocalyx,* based on one of his own collections from Minas Gerais, and characterized by its long-persistent stipules and a reddish calyx.

In examining Pohl's specimen, and others which have since been collected, it has become clear that the Brazilian material differs from the Orinocan in numerous respects, among them: stipules more persistent, cordate-ovate; petiole ca. 0.5 mm thick (0.2–0.3 mm thick in Orinoco material); gland distinctly stipitate; leaflets lanceolate or linear-lanceolate, the superior pair longer, venation prominent on undersurface; pedicels 2.0 cm long or longer; petals 1.5 cm long or longer; ovary and pod glabrous. In fact, Pohl's material is singularly diminutive in comparison with other Goiás collections of similar character (e.g. *Glaziou 20991* and *Irwin 2606*), by which it is clearly related to *C. langsdorffii* var. *parvifoliola.* Furthermore, Bentham's circumscription involved a distributional disjunction of some 1800 miles which has not yet been reduced by any subsequent collections. Although Trans-Amazonian disjunctions of this magnitude are not unknown, e.g. in the euphorbiaceous *Tetrorchidium rubrivenium* Poepp. & Endl. (Smith & Downs, 1959), the morphological dissimilarities exhibited in the 2 regions argue more in favor of approximate morphological convergence than common phyletic origin. Accordingly, the Brazilian material which Bentham included in *C. gracilis* is segregated as *C. langsdorffii* var. *tenuis.*

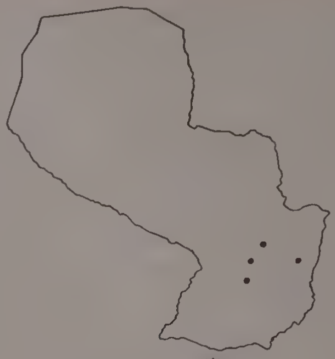
Martius's *C. gracilis* var. *erythrocalyx,* based on one of his own collections from the mountains of Minas Gerais probably in the vicinity of Diamantina, exhibits a character frequently seen in other taxa of section *Xerocalyx*: a reddish or purplish tinge to the calyx, and to the young stipules and leaves as well, probably reflecting mineral deficiencies in the soil. This is undoubtedly a phenotypic expression, and the forms concerned should not be accorded nomenclatural recognition; therefore var. *erythrocalyx* has been regarded as a synonym of *C. gracilis* (sensu Benth.).

COLOMBIA: Puerto Carreno, Río Orinoco, Los Llanos, 23–24 Oct. 1938, *J. Cuatrecasas 4056* (F, US).

VENEZUELA: In the "lajas" region around Pto. Ayacucho, 27 June 1951, *L. Croizat 7* (NY); 1–1.5 km E. of Hotel Amazonas, Pto. Ayacucho, 7 Nov. 1953, *B. Maguire, J. J. Wurdack,* & *G. S. Bunting* 36044 (NY); Maypures, June 1854, *R. Spruce 3807* (K).

5. **Cassia piribebuiensis** Chodat & Hassler, Bull. Herb. Boiss., ser. 2, 4: 825. 1904. Holotype examined (S): Paraguay, "in rupestribus in Colle Tobaty." *Hassler 6118.* Dec. 1900.

Erect herb or subshrub, simple below, usually sparingly branched above, to 0.4 m. Stems smooth, glabrous. Stipules long, foliaceous, wholly or partly obscuring the upper stem, broadly cordate-lanceolate or -ovate, broadly acute, mucronate, 0.8–1.6 cm long, 0.4–0.7 cm broad, glabrous. Petiole 0.4–0.7 cm long, glabrous; rachis ca.



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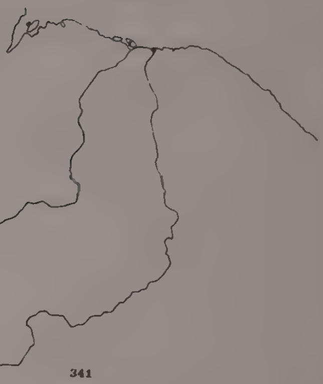

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FIG. 340. Map of Paraguay showing known distribution of *C. piribebuiensis.* FIG. 341. Map of Piauhí, Brazil, showing known distribution of *C. piauhiensis.*

0.5 as long as petiole. Gland 1, scutellate or urceolate, 0.2–0.5 mm broad, elevated on a filiform stipe 0.6–1.2 mm long. Leaflets bijugate, the pairs nearly or quite equal, joined to rachis by a semi-orbicular violet-brown pulvinule 0.5–1.0 mm broad, oblong-obovate or -oblanceolate, slightly oblique, glabrous, firmly membranaceous, 1.5–2.5 cm long, 0.4–0.8 cm broad, yellow-green. Flowers solitary; pedicels straight, glabrous, 2.4–3.7 cm long and ca. 0.4 mm thick in flower, up to 4.1 cm long and 0.7 mm thick in fruit; bracts 2, broadly deltoid, 1.0–1.2 mm long and as broad; bracteoles subopposite, ovate, somewhat divergent, 2.7–3.8 mm long, 1.4–2.4 mm broad; sepals lanceolate, glabrous, 0.9–1.4 cm long, 2.5–3.5 mm broad; petals 1.0–1.5 cm long, 0.7–1.1 cm broad; ovary finely sericeous with appressed hairs. Pod narrowly oblong, 4.2–5.3 cm long, 0.7–0.9 cm broad, faces cristate over the seeds, sparingly puberulent. Seeds 15–25, flattened, 3.0–4.5 mm long, 1.3–2.1 mm broad.

Chromosome number: not determined.

Distribution: Paraguay, in the mountains of the southeastern portion, 1000–3000 feet elevation.

Hassler, in the type description of this species, states that while its affinities lie most closely with *C. uniflora* Spreng., it differs by its stipitate petiolar gland and long stipules. However, in view of the delimitation accorded *C. chartacea* (= C. *uniflora* in part) in the present treatment, it could be argued that the affinities of *C. piribebuiensis* lie more closely with *C. chartacea* var. *tenuicaulis.* The morphological distinctness of *C. piribebuiensis* is none the less quite clear, and for this reason specific status is maintained.

Balansa 1398 approaches *C. piribebuiensis,* but has much broader (1.3–1.6 cm) stipules, and leaflets rather suggestive of Paraguayan specimens of *C. tetraphylla* var. *tetraphylla.*

PARAGUAY: Clairiere, rocailleuse, des forets an dessus de Mhatobi (?), 20 Oct. 1876, *Balansa 1398* (K); Cordillera de Altos, Dec. 1902, *K. Fiebrig 490* (F); Paraguaria centralis, 1897, *E. Hassler 3983* (BM)

6. **Cassia piauhiensis** Irwin, sp. nov.

Holotype (NY): Brazil, Piauhí, "Sud-Piauhy, Campo Grande. Caatinga," *Dr. v. Leutzelberg 366.* May 1914.

Planta suffruticosa, caules decumbentes ascendentesve ad 0.7 m alt., teretes glabros flexuosos habens. Stipulae foliaceae adpressae persistentes late cordato-ovatae obtusae saepe mucronatae 0.8–1.5 cm long, 0.4–0.9 cm lat., glabrae integrae. Petiolus 3–5 mm long. canaliculo adaxiali pubescente, superficie abaxiali pubescente pilosa, pilis distaliter directis; rachis 0.5–0.7 brevior quam petiolus, terminaliter aristata. Glans 1 scutellata aut non profunde urceolata, 0.3–0.5 mm lat., in stipite filiformi 0.7–1.3 mm long. elevata. Foliola bijugata, paribus quasi aequis, per pulvinulum arcuatum plerumque atrum 0.9–1.4 mm long. sessilia, late ovata ad suborbicularia, aliquantulum obliquua, glabra coriacea aut subcoriacea 1.1–2.6 cm long., 0.7–1.7 cm lat.; margo hyalinus integer saepe distaliter undulatus, apice late rotundato. Flores axillares singulares; pedicelli recti glabri, 2.4–3.2 cm long., c. 0.4 mm crass. dum florentes, usque ad 3.7 cm long., 0.8 mm crass. dum frugiferentes; bracteae 2, orbiculares, 1.1–1.4 mm long. et lat.; bracteolae subopposítae, deltoideo-ovatae, 2.8–3.2 mm long., 1.7–2.4 mm lat.; sepala lanceolata glabra, 1.3–1.8 cm long., 0.2–0.4 cm lat.; petala flava, 1.4–2.0 cm long., 0.7–1.6 cm lat.; ovarium seriaceum, pilis adpressis subcinereis praeditum. Siliqua anguste oblonga, 3.0–4.0 (?) cm long., 0.7–0.9 cm lat., facies paululum cristata super semina, modice adpresso-pubescens, praecipue in marginibus. Semina levia, dura, atro-brunnea aut atra, satis compressa, 4.0–6.0 mm long., 1.3–1.7 mm lat.

Subshrub with decumbent or ascending stems to 0.7 m, the stems terete, glabrous, slightly flexuous. Stipules foliaceous, persistent, broadly cordate-ovate, obtuse, often mucronulate, 0.8–1.5 cm long, 0.4–0.9 cm broad, glabrous. Petiole 3–5 mm long, the adaxial groove pubescent, the abaxial surface pubescent and pilose with distally directed hairs; rachis 0.5–0.7 as long as petiole. Gland 1, scutellate or shallowly urceolate, 0.3–0.5 mm broad, elevated on a filiform stipe 0.7–1.3 mm long. Leaflets bijugate, the pairs approximately equal, joined to rachis by an arcuate usually black pulvinule 0.9–1.4 mm long, broadly ovate to suborbicular, somewhat oblique, glabrous, coriaceous or subcoriaceous, 1.1–2.6 cm long, 0.7–1.7 cm broad; margin hyaline, often distally undulate, the apex broadly rounded. Flowers solitary; pedicels straight, glabrous, 2.4–3.2 cm long and ca. 0.4 mm thick in flower, up to 3.7 cm long and 0.8 mm thick in fruit; bracts 2, orbicular, 1.0–1.4 mm long and as broad; bracteoles subopposite, deltoid-ovate, 2.8–3.2 mm long, 1.7–2.4 mm broad; sepals lanceolate, glabrous, 1.3–1.8 cm long, 0.2–0.4 cm broad; petals 1.4–2.0 cm long, 0.7–1.6 cm broad; ovary sericeous with appressed grayish hairs. Pod narrowly oblong, 3.0–4.0 (?) cm long, 0.7–0.9 cm broad, faces slightly cristate over seeds, lightly appressed-pubescent, especially on margins. Seeds slightly compressed, 4.0–6.0 mm long, 1.3–1.7 mm broad.

Chromosome number: not determined.

Distribution: that of the holotype.

This species is as yet represented by a single collection. The marked distinctness of the cited specimen and its apparent geographical isolation from all other closely related taxa favor its specific recognition. The Brazilian state of Piauhí, for which this species is named, and the neighboring states from Maranhão to Bahia, seem inordinantly poor in representatives of the section *Xerocalyx*. It is suspected that this situation is reflective more of infrequent collecting than of actual paucity of *Xerocalyx* material.

The affinities of *C. piauhiensis* are not entirely clear. The large stipules, thick leaflets, and glabrous pedicels suggest relationship to *C. langsdorffii*, but the filiform gland stipe and the fruit characters are more those of *C. ramosa*. However neither of these taxa is yet known from that region.

7a. Cassia langsdorffii Kunth, *in* Vog. Syn. Cass., p. 55. 1837.

var. **langsdorffii**. Photograph of holotype examined (GH, NY): "Brasilia." *Langsdorff s.n.* 1820.

Chamaecrista langsdorffii (Kunth) Britt. ex Pittier, 3rd. Conf. Interam. Agric. Caracas: 373. 1945.

Cassia borbonioides Vog., Syn. Cass., p. 55, 1837.

Erect shrub or subshrub to 1.5 m, simple or with few to many branches, or, in wind-swept mountain fields, many-branched and sub-humifuse; the dorsal side of young parts often purplish. Stipules large, foliaceous, obscuring the glabrous upper stem, lanceolate to ovate, acuminate or more rarely obtuse and mucronate, auriculate or sub-hastatulate, 1.2–2.3 cm long, 0.4–0.8 cm broad, glabrous, coriaceous, the margins hyaline. Petiole 0.5–1.2 cm long, glabrous or the adaxial groove sometimes finely pubescent; rachis 0.2–0.4 times as long as petiole. Gland 1, oblong to suborbicular, ureolate or shallowly scutellate, 1.0–1.4 mm long, 0.9–1.1 mm broad, sessile or elevated on a short thick stipe. Leaflets bijugate (very rarely trijugate), the inferior pair somewhat broader and usually longer, the superior pair usually divergent-falcate, joined to rachis by a small arcuate black, brown or yellowish pulvinule 0.7–1.5 mm long, linear to lanceolate, acuminate to acute or rounded, somewhat oblique, especially at the base, glabrous, coriaceous, 1.8–3.4 cm long, 0.2–0.6 cm broad, commonly gray-green with grayish or yellowish venation and margin; margin usually strongly hyaline, the apex acute, obtuse or less commonly rounded. Flowers mostly solitary, produced intermittently; pedicels straight or arching upward, glabrous, 1.8–2.6 cm long and ca. 0.4 mm thick in flower, up to 3.7 cm long and 1.2 mm thick in fruit; bracts 1 or 2, broadly deltoid or crescentiform, 0.8–1.3 mm long, 1.1–1.5 mm broad; bracteoles subopposite, lanceolate or narrowly ovate, usually appressed, often diverging in fruit, 3.2–5.1 mm long, 1.6–2.7 mm broad; sepals lanceolate, glabrous, 1.2–1.7 cm long, 0.4–0.6 cm broad; petals about as long as sepals, 0.7–1.4 cm broad; ovary sparsely to copiously sericeous with grayish appressed hairs. Pod firm, narrowly oblong, 3.5–6.1 cm long, 0.6–0.9 cm broad, faces often strongly cristate over seeds, glabrous or sparsely appressed-pubescent. Seeds slightly flattened, 4.0–6.2 mm long, 1.4–1.7 mm broad.

Chromosome number: $n = 7$.

Distribution: South Brazil, in southern Mato Grosso and Goiás, south through Minas Gerais and São Paulo to Paraná, and in adjacent Paraguay. Occurring in savannas and open woods (cerrados) on sandy clay soil, and in open places on mountain slopes and summits, at elevations of 500–3000 feet.

In his treatment of *Cassia* in Flora Brasiliensis, Bentham was obviously troubled by *C. langsdorffii,* and, in recognition of the variability he discerned, appended 4 unnamed forms, presumably of potential varietal rank. Because of the relative paucity of material at his disposal, his lack of field experience in Brazil, and perhaps his interest in not cluttering the nomenclature with questionable taxa, Bentham fortunately refrained from designating these variants names. Careful examination of material used in support of them as well as additional material has shown that because Bentham weighed leaflet width rather heavily as a character of *C. langsdorffii* and did not envisage this character as a variable one in *C. tetraphylla* and *C. chartacea* as well, 3 of the variants he enumerated are, on the basis of total characters, in fact more closely related to these 2 latter taxa.

The first form, based on *Blanchet 2536,* from Bahia, and *Martius s.n.,* from Manaus, is, when one considers the small stipules, short pedicels, large flowers, and pubescent fruit, very closely related to *C. tetraphylla* var. *brevipes.* The former specimen, however, is especially striking and is scarcely different from *Gardner 2828,* from Pernambuco, which Bentham cited, together with *Martius s.n.* from Minas Gerais (not seen), as the basis for his second form, distinguishing it from the first by "foliolis angustissimis acutis submarginatis," narrow stipules, and flowers of moderate size. Close examination shows that these specimens (i.e. *Blanchet 2536* and *Gardner 2828*) are virtually alike; accordingly they are treated under *C. tetraphylla* var. *linearis* in the present treatment. *Spruce 3646,* from the Orinoco, which Bentham felt was similar to the Brazilian material in form 2, is, like the Manaus material of Martius, close to *C. tetraphylla* var. *brevipes.*

Burchell 3574, from São Paulo, which documents the 3rd form, and which Bentham recognized as similar to the Sellowian type of *C. borbonioides,* clearly falls within the limits of variability of the here described *C. langsdorffii* var. *langsdorffii.* Although rather small in stipule and leaflet dimension, it agrees very closely with the typical variety.

In *Burchell 4280,* also from São Paulo, and the basis for the 4th form, Bentham felt he had found an intermediate between *C. langsdorffii* and *C. gracilis.* For reasons mentioned in the present treatment of the latter species, this intermediacy, if indeed it is tenable, lies elsewhere, most probably with *C. chartacea,* largely on the basis of the slender petiole, small gland, membranaceous leaflets, and slender pedicels, and more particularly with *C. chartacea* var. *tenuicaulis* because of the slender stems and decumbent habit.

This is not to deny variability in *C. langsdorffii* var. *langsdorffii,* even as here conceived. As will be discussed under *C. chartacea,* a number of forms found in Minas Gerais and Goiás are indeed perplexing, but should, at least until both *C. chartacea* and *C. langsdorffii* become better known, be included with *C. chartacea,* detailed study of characters showing affinity to lie more clearly in the direction of that taxon. Specimens of *C. langsdorffii* var. *langsdorffii* from the southern portion of Serra do Espinhaço, especially Serra do Cipó, in Minas Gerais, show considerable variability in foliar characters. For example, *Duarte 1983* and *Irwin 2524a* have

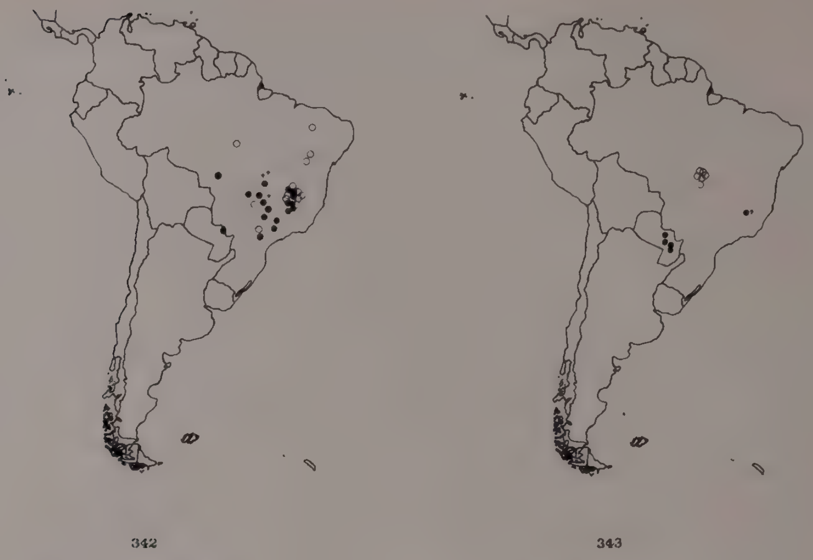


FIG. 342. Map showing distribution of *C. langsdorffii* var. *langsdorffii* (closed circles) *C. langsdorffii* var. *parvifoliola* (open circles), and *C. langsdorffii* var. *tenuis* (crosses). FIG. 343. Map showing distribution of *C. langsdorffii* var. *longipedicellata* (open circles) and *C. langsdorffii* var. *latifoliola* (closed circles).

ovate stipules, rounded leaflet apices, and short pedicels, but in other respects agree closely with the typical variety.

BRAZIL, GOIAS: Vargem Grande, dans le Chapadão dos Veadeiros, 6 Jan. 1895, *A. Glaziou 20990* (BM, K, NY, S in part); 139 km W of Rio Verde on road to Caiaponha, 3 Feb. 1959, *H. S. Irwin 2568* (MICH, NY, R, TEX, UC, US, VIC); Brasília (D. F.), 7 Feb. 1959, *H. S. Irwin 2601* (MICH, NY, R, TEX, UC, US, VIC). MATO GROSSO: Santa Anna da Chapada, 26 May, 1903, *G. Malme s.n.* (S). MINAS GERAIS: Minas Geraes, 1840, *Claussen s.n.* (BM, K); Minas Geraes, 1839, *Claussen s.n.* (MICH) Minas Geraes, w/o date, *Claussen 852* (S); Serro do Cipó, Palácio, 3 Dec. 1949, *A. P. Duarte 1983* (MO); Lagôa Seca, Serra do Curral, Municipio Belo Horizonte, 2 Jan. 1959, *H. S. Irwin 2364* (MICH, NY, R, TEX, UC, US, VIC); Lower slopes of Serra da Piedade, ca. 10 km S of Caeté, 9 Jan. 1959, *H. S. Irwin 2409* (MICH, NY, R, TEX, US, VIC); Serra do Cipó, 12 km E of S. José do Almeida, on road to Morro do Pilar, 12 Jan. 1959, *H. S. Irwin 2425a* (MICH, NY, R, TEX, UC, US, VIC); 50 km SE of Uberlândia on road to Altos Campos, 31 Jan. 1959, *H. S. Irwin 2524* (MICH, NY, R, TEX, UC, US, VIC); 29 km W of Uberlândia on road to Tupaciguara, 1 Feb. 1959, *H. S. Irwin 2533* (MICH, NY, R, TEX, UC, US, VIC); Uberava, Dec. 1848, *Regnell II 74* (S); In campis siccis gram. St. Carlos, Jan. 1834, *Riedel 1923* (US); S. Francisco (?) de Chave, 1844, *Weddell 1897* (P); Hill near "Cruzeiro," near Belo Horizonte, Município of Belo Horizonte, 6 Mar. 1945, *L. O. Williams & V. Assis 5874* (GH). PARANA: Jaguariahyva, 6 Feb. 1910, *P. Dusén 9228* (BM, S, US). SAO PAULO: w/o locality (Prov. S. Paulo), w/o date, *W. J. Burchell 5394* (K); W/o locality (Prov. S. Paulo), w/o date, *W. J. Burchell 5574* (K); S. José dos Campos, 30 Dec. 1908, *A. Löfgren 173* (S).

PARAGUAY: In altaplanitie et declivibus "Serra de Amambay," Jan. 1908, *E. Hassler 10031* (BM, NY, S, UC).

7b. Cassia langsdorffii var. **longipedicellata** Irwin, var. nov. Holotype (K): Brazil, Goiás, "Porto Real." Burchell 8490. 1828–1829. Isotype (GH).

Planta herbacea aut suffruticosa, decumbens aut humifusa, ramos paucos divergentes ad 0.5 m long. habens. Stipulae magnae foliaceae adpressae persistentes, caulem superiorem glabrum omnino aut partim celantes, cordato-ovatae ad -lanceolatae, acuminatae, interdum abrupte, 1.1–1.9 cm long., 0.4–0.7 cm lat., glabrae integrae. Petiolus 0.4–0.5 cm long., canaliculo adaxiali puberulente, superficie abaxiali glabra aut pilis paucis distaliter directis praedita; rachis 0.3–0.5 brevior quam petiolus, terminaliter aristata. Glans 1 plerumque scutellata, 0.3–0.5 mm lat., sessilis aut brevissime stipitata. Foliola bijugata paribus subaequis, per pulvinulum parvum arcuatum brunneum ad atrum 0.7–1.2 mm long. sessilia, oblongo-obovata, plus minusve obliqua, glabra, firme membranacea, 1.4–2.1 cm long., 0.5–0.8 cm lat.; margines integri, saepe distaliter undulati, apice late obtuso rotundatove. Flores axillares singulares; pedicelli recti, glabri aut raro in linea puberulentes, 3.0–4.3 cm long., c. 0.4 mm crass. dum florentes, usque ad 5.2 cm long., 0.8 mm crass. dum frugiferentes; bracteae 2 deltoideo-ovatae, 1.5–2.1 mm long., 0.8–1.5 mm lat., bracteolae suboppositae, lanceolatae ad ovatas, 1.7–2.3 mm long., 1.1–1.6 mm lat.; sepala lanceolata, glabra, 1.3–1.6 cm long., 0.2–0.3 cm lat.; petala flava, quasi aeque longa ac sepala, 0.7–1.2 cm lat.; ovarium subtiliter sericeum, pilis adpressis subcineriis. Siliqua anguste oblonga, 3.6–4.5 cm long., 0.5–0.7 cm lat., superficies quasi cristata super semina, parcissime adpresso-pubescens. Semina non visa.

Decumbent or humifuse herb or subshrub with few divergent branches to 0.5 m long. Stipules large, foliaceous, wholly or partly obscuring the glabrous upper stem, cordate-ovate to -lanceolate, acuminate, sometimes abruptly so, 1.1–1.9 cm long, 0.4–0.7 cm broad, glabrous. Petiole 0.4–0.5 cm long, the adaxial groove puberulent, the abaxial surface glabrous or with a few distally directed hairs; rachis 0.3–0.5 as long as the petiole. Gland 1, usually scutellate, 0.3–0.5 mm broad, sessile or very short-stipitate. Leaflets bijugate, the pairs subequal, sessile by a small arcuate brown or black pulvinule 0.7–1.2 mm long, oblong-obovate, more or less oblique, glabrous, firmly membranacous, 1.4–2.1 cm long, 0.5–0.8 cm broad; margins often distally undulate, the apex broadly obtuse or rounded. Flowers solitary; pedicels straight, glabrous or rarely puberulent in a line, 3.0–4.3 cm long and ca. 0.4 mm thick in flower, up to 5.2 cm long and 0.8 mm thick in fruit; bracts 2, deltoid-ovate, 1.5–2.1 mm long, 0.8–1.5 mm broad; bracteoles subopposite, lanceolate to ovate, 1.7–2.3 mm long, 1.1–1.6 mm broad; sepals lanceolate, glabrous, 1.3–1.6 cm long, 0.2–0.3 cm broad; petals about as long as the sepals, 0.7–1.2 cm broad; ovary finely sericeous with appressed grayish hairs. Pod narrowly oblong, 3.6–4.5 cm long, 0.5–0.7 cm broad, faces somewhat cristate over the seeds, very sparsely appressed-pubescent. Seeds not seen.

Chromosome number: not determined.

Distribution: Brazil: central Goiás in the drainage of the upper Rio Tocantíns, elevation 1800–3000 feet. Habitats not known.

This variety is based on 3 collections by Burchell, all taken in 1828–1829 in the vicinity of Porto Real, and one by Gardner from "Goyaz" in 1841. Since central Goiás has received very little attention in more recent years, it is not surprising that additional material has failed to appear in herbaria. It may be significant, in regard to the southern distributional limit of this variety, that in the Machris Expedition

to the Chapada dos Veadeiros, south of Burchell's stations, and the present author's visit to Serra da Caiapó, in southwestern Goiás, no material referable to this variety was found.

BRAZIL, GOIAS: Porto Real, 30 Jan. 1829, *Burchell 8554-3* (K); Porto Real, 30 Jan. 1829, *Burchell 8679–19* (GH, K); "Goyaz," 1841, *Gardner 3687* (K).

7c. Cassia langsdorffii var. latifoliola Irwin, var. nov.

Holotype (US): Paraguay, "in regione fluminis Alto Paraná," *K. Fiebrig 6447*. 1909–1910. Isotypes (BM, GH, SI).

Planta suffruticosa caules erectos aut adscendentes paucos ad aliquot 0.3–0.8 m alt. habens. Caules teretes, striati glabri. Stipulae magnae foliaceae adpressae persistentes caulem superiorem omnino aut partim celantes, oblongae ovataeve, saepe auriculatae obtusae interdum mucronulatae, 1.0–1.4 cm long., 0.4–0.8 cm lat., glabrae integrae. Petiolus 0.4–0.6 cm long., canaliculo adaxiali glabro aut parce pubescente, superficie abaxiali parce pilosa, pilis distaliter directis; rachis 0.3–0.5 brevior quam petiolus, terminaliter aristata. Glans 1 oblonga ovatave, scutellata, 1.3–1.8 mm long., 0.7–1.1 mm lat., subsessilis aut in stipite brevi crasso elevata. Foliola bijugata, longitudine subaequa, pari inferiore plerumque latiore, per pulvinulum parvum atrum 0.9–1.3 mm long. sessilia, lanceolato-oblonga ad obovata, basaliter obliqua glabra coriacea, 1.4–2.6 cm long., 0.4–1.0 cm lat., margines integri, plus minusve hyalini, apice late obtuso rotundatove. Flores axillares singulares; pedicelli late divergentes plerumque sursum arcuati, glabri, 1.0–2.5 cm long., 0.5 mm crass. dum florentes, usque ad 2.7 cm long., 1.2 mm crass. dum frugiferentes; bracteae 2 late deltoideo-ovatae aut -ellipticae, 2.9–3.7 mm long., 2.0–2.6 mm lat.; bracteolae paribus uno duobusve, unoquoque in pari suboppositae, lanceolatae, adpressae aut divergentes, 3.0–4.3 mm long., 0.8–1.3 mm lat.; sepala late lanceolata ovatave, glabra, 1.5–2.2 cm long., 0.4–0.7 cm lat.; petala flava, 1.4–1.8 cm long., 0.7–1.4 cm lat.; stamina flava; ovarium sericeum pilis subflavis subcinereisve. Siliqua anguste oblonga, recta aut paululum declinata, 4.8–6.3 cm long., 0.6–0.8 cm lat. superficies super semina cristata, parce adpresso-pubescentes. Semina glabra dura atro-brunnea aut atra, complanata, 4.0–5.5 mm long., 1.5–2.1 mm lat.

Subshrub with few to several erect or ascending stems 0.3–0.8 m tall. Stems terete, striate, glabrous. Stipules large, foliaceous, wholly or partly obscuring the upper stem, oblong or ovate, often auriculate, obtuse, sometimes mucronulate, 1.0–1.4 cm long, 0.4–0.8 cm broad, glabrous. Petiole 0.4–0.6 long, the adaxial groove glabrous or sparingly pubescent, the abaxial surface sparsely pilose with distally-directed hairs; rachis 0.3–0.5 as long as petiole. Gland 1, oblong or ovate, scutellate, 1.3–1.8 mm long, 0.7–1.1 mm broad, subsessile or elevated on a short thick stipe. Leaflets bijugate, subequal in length, the inferior pair usually broader, joined to rachis by a small black pulvinule 0.9–1.3 mm long, lanceolate-oblong to obovate, basally oblique, glabrous, coriaceous, 1.4–2.6 cm long, 0.4–1.0 cm broad; margins more or less hyaline, the apex broadly obtuse or rounded. Flowers solitary; pedicels widely divergent, usually arching upward, glabrous, 1.0–2.5 cm long and ca. 0.5 mm thick in flower, up to 2.7 cm long and ca. 1.2 mm thick in fruit; bracts 2, broadly deltoid-ovate or -elliptic, 2.9–3.7 mm long, 2.0–2.6 mm broad; bracteoles 1 or 2 pairs, subopposite in each pair, lanceolate, appressed or divergent, 3.0–4.3 mm long, 0.8–1.3 mm broad; sepals broadly lanceolate or ovate, glabrous, 1.5–2.2 cm long, 0.4–0.7 cm

broad; petals, 1.4–1.8 cm long, 0.7–1.4 cm broad; ovary sericeous with yellowish or grayish hairs. Pod narrowly oblong, straight or somewhat declined, 4.8–6.3 cm long, 0.6–0.8 cm broad, faces cristate over the seeds, sparsely appressed-pubescent. Seeds flattened, 4.0–5.5 mm long, 1.5–2.1 mm broad.

Chromosome number: not determined.

Distribution: Paraguay, in the highlands of the southeastern portion, elevation 1000–2000 feet, northeastward through São Paulo to central Minas Gerais, Brazil. Habitats not known.

This variety is based on 4 collections from the west drainage of the upper Rio Paraná. Although no similar material has yet appeared from the adjacent Brazilian state of Paraná, *Voy. de St. Hilaire 1347* (P) from São Paulo and *Mello Barreto 5940* (F) from Serra do Cipó in Minas Gerais are both very similar to the Paraguayan material and are referred to this variety.

Affinity to *C. langsdorffii* is seen in the large oblong petiolar gland, large stipules, thick leaflets, and firm fruit. However the large flowers are more those of *C. tetraphylla,* which, as will be seen, is a wide-spread highly variable taxon distributed almost throughout the range of *C. langsdorffii*. It is suspected that occasional hybridization and "gene flow" between these 2 taxa is considerable.

BRAZIL, MINAS GERAIS: Serra do Cipó, k. 139—estrada do Pilar, 11 Jan. 1934, *Mello Barreto 5940* (F). SAO PAULO: w/o locality (Prov. S. Paulo), 1816—1821, *Voyage d'Auguste de Saint-Hilaire 1347* (P).

PARAGUAY: In regione fluminis Alto Paraná, 1909—10, *K. Fiebrig 6223* (SI, US); In viciniis Caaguazú, 1905, *Hassler 9263* (BM); In the campo, Estância Primera, Jan. 1932, *P. Jorgensen 4826* (F, GH, MICH, SI, US).

7d. **Cassia langsdorffii** var. **tenuis** Irwin, var. nov.

Holotype (NY): Brazil, Goiás, "Serra de Chrystaes." *Pohl 906*. 1818. Isotypes (F, GH, MO).

Planta suffruticosa fruticosave ad 1.5 m alt. erecta ramosissima saepe late patens. Caules tenues flexuosi, iuvenes interdum puberulentes. Stipulae deciduae, infra nodum decimum raro persistentes, cordato-ovatae aut lanceolatae, acutae aut breviacuminatae 1.9–3.4 (–4.1) mm long., 0.7–1.6 (–2.2) mm lat., glabrae integrae. Petiolus 1.2–2.7 mm long., glaber aut puberulens; rachis 0.3–0.5 brevior quam petiolus, terminaliter aristulata. Glans 1, scutellata urceolatave, 0.3–0.5 mm lat., subsessilis aut in stipite 0.2–0.6 mm long. elevata. Foliola bijugata, pari superiore multo longiore, per pulvinulum minutum arcuatum aut suborbicularem 0.4–0.6 mm long. sessilia, lanceolata oblanceolatave ad anguste oblonga, ad basim obliqua, plerumque aliquantulum falcata glabra firme membranacea aut subcoriacea, 0.5–1.3 cm long., 1.5–3.5 mm lat., integra, venatione perspicua, praecipue in superficie inferiore. Flores axillares singulares; pedicelli filiformes, plerumque recti, glabri aut parcissime puberulentes, 2.0–2.4 cm long dum florentes, usque ad 3.0 cm long. dum frugiferentes; bracteae 2, late ovatae aut crexcentiformes, 0.4–0.6 mm long., 0.5–0.8 mm lat.; bracteolae suboppositae, divergentes caducae, anguste ad late ovatae, 1.6–3.1 mm long., 1.2–2.2 mm lat.; sepala lanceolata ad anguste ovata, 1.0–1.6 cm long., 0.3–0.5 cm lat., glabra, cacuminibus saepe subpurpureis; petala flava, 1.5–1.9 cm long., 1.1–1.6 cm lat.; stamina flava; ovarium glabrum aut adpresso-puberulens. Siliqua oblonga aut anguste oblonga, 2.4–3.8 cm long., valvae planae aut paululum super semina cristatae, glabrae aut parce puberulentes, saepe glaucae. Semina 8–13, levia dura atro-brunnea aut atra, compressa 3.8–4.7 mm long., 1.7–2.3 mm lat.

Erect much-branched often wide-spreading subshrub or shrub, to 1.5 m. Stems slender, flexuous, sometimes puberulent when young. Stipules deciduous, seldom persisting below the tenth node, cordate-ovate or lanceolate, acute or short-acuminate, 1.9–3.4 (–4.1) mm long, 0.7–1.6 (–2.2) mm broad, glabrous. Petiole 1.2–2.7 mm long, glabrous or puberulent; rachis 0.3–0.5 as long as petiole. Gland 1, scutellate or urceolate, 0.3–0.5 mm broad, subsessile or elevated on a stipe 0.2–0.6 mm long. Leaflets bijugate, the superior pair much longer, joined to rachis by a minute arcuate or suborbicular pulvinule 0.4–0.6 mm long, lanceolate or oblanceolate to narrowly oblong, oblique at base, usually somewhat falcate, glabrous, firmly membranaceous or subcoriaceous, 0.5–1.3 cm long, 1.5–3.5 mm broad, venation distinct, especially on under surface. Flowers solitary; pedicels filiform, usually straight, glabrous or very sparsely puberulent, 2.0–2.4 cm long in flower, up to 3.0 cm long in fruit; bracts 2, broadly ovate or crescentiform, 0.4–0.6 mm long, 0.5–0.8 mm broad; bracteoles subopposite, divergent, caducous, narrowly to broadly ovate, 1.6–3.1 mm long, 1.2–2.2 mm broad; sepals lanceolate to narrowly ovate, glabrous, often purplish-tipped, 1.0–1.6 cm long, 0.3–0.5 cm broad; petals 1.5–1.9 cm long, 1.1–1.6 cm broad; ovary glabrous or appressed-puberulent. Pod oblong or narrowly oblong, 2.4–3.8 cm long, 4.5–5.6 mm broad, valves flat or slightly cristate over seeds, glabrous or sparingly puberulent, often glaucous. Seeds 8–13, compressed, 3.8–4.7 mm long, 1.7–2.3 mm broad.

Chromosome number: $n = 7$ (Irwin & Turner, 1960: cited as *C. gracilis*).

Distribution: Brazil, southern Goiás and central and western Minas Gerais. Occurring in savannas and low open woods (cerrados), chiefly on white and gray sandy soils.

As has been mentioned in connection with *C. gracilis,* the present taxon is based, in part, on Brazilian material considered by Bentham to be within the delimitation of that species (including *C. gracilis* var. *erythrocalyx* Mart.), but on close examination differing from the Orinocan specimens in many characters. *Irwin 2606,* and to some extent *Glaziou 20991,* both referable to *C. langsdorffii* var. *tenuis,* closely approach *C. langsdorffii* var. *parvifoliola* in foliar characters, but retain the distinct stipules, pedicels, and bracteoles, as well as the characteristic habit, rather analogous to the "vase form" of *Ulmus americana,* which mark the present variety.

BRAZIL, GOIAS: 124 km S of Brasilia on road to Cristalina, 8 Feb. 1959, *H. S. Irwin 2606* (MICH, NY, R, UC, US, VIC). MINAS GERAIS: w/o locality (Minas), w/o date, *A. Glaziou 19080* (K); Habitat in montibus dist. Adamant., prov. Minas Geraes, 1827–1828, *Martius s.n.* (M); Diamantina–Rio das Pedras, 29 May 1955, *E. Pereira 1640* (MO).

7e **Cassia langsdorffii** var. **parvifoliola** Irwin, var. nov.

Holotype (TEX): Brazil, Minas Gerais, "Serra do Cipó, 15 km E of S. José do Almeido, on road to Morro Pilar." *H. S. Irwin 2429.* 12 Jan. 1959. Isotypes (MICH, NY, R, UC, US, VIC).

Planta suffruticosa erecta aut decumbens, ad 1.5 m alt., parce ad copiose ramosa. Stipulae adpressae persistentes, cordato-lanceolatae, acuminatae, 3.5–8.0 mm long., 1.5–3.0 mm lat., glabrae integrae. Petiolus 1.0–3.0 mm long., canaliculo adaxiali atque superficie abaxiali glabris aut raro pubescentibus; rachis aeque longa ac petiolus aut 0.5 brevior, terminaliter 0.6 mm lat., in stipite 0.2–0.7 mm alt. elevata, raro sessilis. Foliola bijugata, superiore pari longiore saepe divergenti-falcato, per pulvinulum parvum arcuatum atrum aut brunneum aut subflavum 0.2–0.4 mm long. sessilia, linearia aut lineari-lanceolata, ad basim obliqua glabra firme membranacea aut subcoriacea 0.9–2.1 cm long., 1.5–2.6 mm lat., plerumque flavo- aut cinereo-viridia, marginibus integris, saepe quasi hyalinis. Flores axillares, maxima ex parte singulares, intermittenter productae; pedicelli recti glabri aut raro in linea puberulentes, 0.4–2.0 cm long., 0.3–0.4 mm crass. dum florentes, usque ad 3.0 cm long., 0.7 mm crass. dum frugiferentes; bracteae 2, late deltoideae aut crescentiformes 0.4–0.7 mm long., 0.5–0.9 mm lat.; bracteolae suboppositae, lanceolatae ad ovatae, saepe divergentes, 2.0–3.2 mm longae, 0.5–1.3 mm latae; sepala lanceolata glabra, 1.3–1.6 cm long., 0.2–0.3 cm lat.; petala flava, quasi aeque longa ac sepala, 0.7–1.2 cm lat.; stamina flava; ovarium glabrum ad subiliter adpresso-sericeum.. Siliqua anguste oblonga, 2.2–3.4 cm long., 0.6–0.8 cm lat., superficies plana aut super semina paululum cristata, glabra aut parce adpresso-pubescens. Semina glabra dura atro-brunnea aut atra, paululum compressa, 3.5–5.0 mm long., 1.6–2.1 mm lat.

Erect or decumbent subshrub to 1.5 m, sparingly to copiously branched. Stipules cordate-lanceolate, acuminate, 3.5–8.0 mm long, 1.5–3.0 mm broad, glabrous. Petiole 1.0–3.0 mm long, the adaxial groove and abaxial surface glabrous or rarely pubescent; rachis 0.5–1.0 as long as petiole. Gland 1, scutellate or shallowly urceolate, 0.4–0.6 mm broad, elevated on a stipe 0.2–0.7 mm high, rarely sessile. Leaflets bijugate, the superior pair longer and often divergent-falcate, sessile by a small arcuate black, brown, or yellowish pulvinule, 0.2–0.4 mm long, linear or linear-lanceolate, oblique at the base, glabrous, firmly membranaceous or subcoriaceous, 0.9–2.1 cm long, 1.5–2.6 mm broad, commonly yellow- or gray-green, the margins often somewhat hyaline. Flowers mostly solitary, produced intermittently; pedicels straight, glabrous or rarely puberulent in a line, 0.4–2.0 cm long and 0.3–0.4 mm thick in flower, up to 3.0 cm long and 0.7 mm thick in fruit; bracts 2, broadly deltoid or crescentiform, 0.4–0.7 mm long, 0.5–0.9 mm broad; bracteoles subopposite, lanceolate to ovate, often divergent, 2.0–3.2 mm long, 0.5–1.3 mm broad; sepals lanceolate, glabrous, 1.3–1.6 cm long, 0.2–0.3 cm broad; petals about as long as the sepals, 0.7–1.2 cm broad; ovary glabrous to finely appressed-sericeous. Pod narrowly oblong, 2.2–3.4 cm long, 0.6–0.8 cm broad, faces plane or slightly cristate over seeds, glabrous or sparsely appressed-pubescent. Seeds slightly compressed, 3.5–5.0 mm long, 1.6–2.1 mm broad.

Chromosome number: $n = 7$.

Distribution: Brazil, Ceará, southward through Bahia, Minas Gerais, and southern Goiás to São Paulo. Perhaps also in southern Pará. Occurring in mountainous regions, chiefly on white or gray sandy soils, elevation 1500–3500 feet.

This variety is based on a number of collections which, taken as a whole, show a wide distribution in eastern and southern Brazil, mostly at elevations higher than those frequented by *C. langsdorffii* var. *langsdorffii,* and which are distinguished not only by generally smaller foliar organs but also by the larger, often diverging distal pair of leaflets. The indicated type has been chosen instead of the older *Riedel 314* of Bahia, because of the rather minute stipules and slender stems of the latter.

While *C. langsdorffii* var. *parvifoliola* most nearly approaches *C. langsdorffii* var. *langsdorffii,* especially in the southern portion of Serra do Espinhaço in Minas

Gerais, a small population in Serra do Cipó (*Irwin 2429*) was seen to intergrade quite clearly with *C. tecta* (*Irwin 2430*). The biochemical similarity in chromotographic patterns of *C. langsdorffii* var. *parvifoliola* and *C. tecta* (Fig. 329, and Fig. 331 and 332: G, H; and Fig. 330, Fig. 333 and 334: D, E) further indicates the close relationship of the latter species with the *C. langsdorffii* complex.

Pires et al. 6200, from Serra do Cachimbo on the southern border of Pará, approaches the Minas Gerais material except for its very small stipules and leaflets. But then the whole presumed northern range of this variety is inadequately defined owing to the paucity of collections from that area.

BRAZIL, BAHIA: Entre Palmeiras e Lencoes, 14 Sept. 1956, *E. Pereira 2216* (F). GOIAS: Chapadão dos Veadeiros, 6 Jan. 1895, *A. Glaziou 20990* (S (in part), UC (in part), US (in part)). MINAS GERAIS: Minas Geraes, 1892, *A. Glaziou 19093* (NY); Serro do Cipó, 16 Jan. 1951, *J. G. Kuhlmann* & *L. Edmundo 16* (MO); Serra do Cipó, km 115, 13 Jan. 1935, *Mello Barreto 5942* (F, MICH); w/o locality (Minas Gerais), Jan. 1951, *J. M. Pires* & *G. A. Black 2984* (NY); Serra da Lapa, Nov. 1824, *Riedel 879* (US). PARA: Serra do Cachimbo, 14 Dec. 1956, *J. M. Pires, G. A. Black, J. J. Wurdack,* & *N. T. Silva 6200* (NY, US).

8a. Cassia curvifolia Vogel, Syn. Cass., p. 55. 1837. var. **curvifolia.** Photograph of isotype examined (M): Brazil, Minas Gerais, "Habitat in altis montanis herbidis ad Diamantina et alibi." *Martius s.n.* w/o date (collected in Brazil 1817–1820).

Erect shrub or subshrub, usually divaricately much-branched, to 1.5 m. Stems pubescent or puberulent, at least when young; internodes short, 2.0–5.5 mm long. Stipules long-persistent, wholly or partly obscuring the upper stem, ovate-cordate, short-acuminate to obtuse, 2.5–5.1 mm long, 1.6–2.9 mm broad, glabrous and often ciliolate to lightly puberulent. Petiole abbreviate, 0.5–1.0 mm long, puberulent or pubescent; rachis about as long as the petiole. Gland 1, usually urceolate, minute, sessile or on a short thick stipe. Leaflets bijugate, the superior pair longer, joined to rachis by a small arcuate or semi-orbicular pulvinule 0.1–0.3 mm long, falcate-obovate or -oblong, glabrous and often ciliolate to lightly puberulent, subcoriaceous, 2.7–7.8 mm long, 1.4–2.7 mm broad; apex obliquely obtuse to inflexed-mucronate. Flowers axillary, solitary or rarely in pairs; pedicels usually straight, puberulent, 5.4–8.1 mm long and ca. 0.3 mm thick in flower, up to 13.5 mm long and 0.7 mm thick in fruit; bracts 2, puberulent, suborbicular, divergent, 1.9–2.6 mm long, 1.6–2.3 mm broad; sepals lanceolate to broadly lanceolate, 0.6–1.1 cm long, 2.6–3.4 mm broad; petals 0.8–1.3 cm long, 0.6–1.1 cm broad; ovary glabrous or puberulent. Pod narrowly oblong, 2.9–3.5 cm long, 0.4–0.6 cm broad, faces usually cristate over the seeds, glabrous, or puberulent on sutures, or generally puberulent. Seeds 10–16, slightly flattened, 3.1–4.7 mm long, 1.1–1.7 mm broad.

Chromosome number: not determined.

Distribution: Brazil, from the lower north drainage of the Amazon in Pará and Amapá, eastward to Maranhão and Ceará, south through Bahia to Goiás and central Minas Gerais. Occurring in savannas, open woods, and in mountain fields, mostly on sandy soils.

Cassia curvifolia is a well marked species, tolerant of a wide spectrum of environmental conditions, and showing no clear affinity with any other taxon, save possibly *C. langsdorffii* through an extreme form of the var. *lucida.*

The leaflets of the var. *curvifolia,* smallest of those of any taxon in the section *Xerocalyx,* are usually apiculate in Amazon material, tending to become smaller and more rounded in the drier parts of the northeastern states, and showing no marked distinction further south. The type collection is from the extreme southern portion of the known distribution of this variety. However, it may be expected to occur further southward in the Serra do Espinhaço at Serra do Cipó.

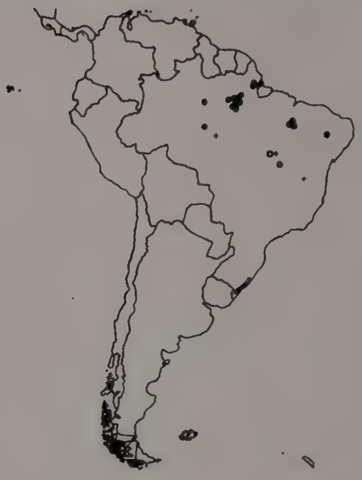
BRAZIL, AMAPA: Macapá, Porte Grande, 29 Oct. 1957, *W. A. Egler 634* (MG). BAHIA: Região do Barreiras, Serra do aeroporto, 5 Jan. 1953, *G. A. Black 55–18053* (NY) ; Rio das Fimeas (?) , Agreste (?) 1913, *Leutzelburg 1514* (US) . CEARA: Dry hills near Crato, Sept. 1838, *Gardner 1574* (BM, GH, K, NY, P, US); Couri-Crato, 5 Aug. 1948, *A. P. Duarte* 1288 (MO) . GOIAS: Serra Geral, Aug. 1912, *Leutzelburg 628* (NY) . MARANHAO: Grajahú, 30 July 1909, *A. Lisbôa 2498* (BM, MG, US). PARA: Santarém, 12 Aug. 1902, *A Ducke 2930* (MG) ; Prainha, 11 May 1903, *A. Ducke 3627* (MG) ; Campos de Ariramba, 23 Dec. 1906, *A. Ducke 8086* (MG) ; Campos a E. de Ferro, 21 Aug. 1907, *A. Ducke 9966* (MG) ; Ariramba, Rio Trombetas, 28 May 1957, *W. A. Egler 339* (MG) ; Mazagão, Rio Maracá, Aug. 1896, *M. Guedes 589* (BM, MG); Villa Franca, 9 July 1899, *D. Huber 1634* (MG); Santarém, 28 Mar. 1924, *J. G. Kuhlmann 17807* (S, U) ; Santarém, 1837, *Herb. Mus. Petrop. 31* (K); Santarém, 25. Dec. 1956, *J. M. Pires, G. S. Black, J. J. Wurdack, & N. T. Silva 6478a* (NY); Montealegre, Serra de Ereré, 21 July 1908, *E. Snethlage 9512* (BM, MG); Campos above Santarém, Oct. 1848, *R. Spruce 292* (K) ; Prainha, 29. Nov. 1873, *J. W. H. Traill 176* (K).

8b. Cassia curvifolia var. **mollissima** Bentham, *in* Mart. Fl. Bras. XV (II) : 160. 1870. Photograph of holotype examined (M) : Brazil, Minas Gerais, "habitat in campis alpestribus prope Tepuo et alibi Serro Frio." *Martius s.n.* w/o date (collected in Brazil 1817–1820) .

Shrub or subshrub with few to numerous divaricate, finely pubescent, erect or ascending branches, to 1.5 m. Stipules persistent, wholly or partly obscuring upper stem, cordate-ovate, short-acuminate, 2.7–5.3 mm long, 1.7–2.9 mm broad, downy- to velvety-pubescent. Petiole abbreviate, 0.5–1.0 mm long, puberulent or finely pubescent; rachis as long or longer than petiole. Gland 1, urceolate or globular, 0.3–0.5 mm broad, sessile or very short-stipitate. Leaflets bijugate, the superior pair much longer, sessile by a small hemispherical pulvinule ca. 0.3 mm broad, falcate-obovate, velvety-puberulent to -pubescent, coriaceous, 0.2–1.2 cm long, 2.0–3.5 mm broad; apex obliquely obtuse of inflexed-mucronate. Flowers solitary; pedicels straight or arching upward, pubescent, 0.9–1.2 cm long and ca. 0.3 mm thick in flower, up to 1.4 cm long and 0.5 mm thick in fruit; bracts 2, pubescent, broadly crescentiform, 0.1–0.3 mm high, 0.4–0.7 mm broad; bracteoles subopposite, deciduous, pubescent without, glabrous within, broadly ovate or nearly orbicular, 2.6–3.0 mm long, 2.1–2.7 mm broad; sepals lanceolate or broadly lanceolate, yellow-pubescent without, especially toward the apex, glabrous within, 0.6–1.4 cm long, 0.3–0.5 cm broad; petals 1.0–1.6 cm long, 0.7–1.2 cm broad; ovary sericeous-puberulent. Pod narrowly oblong, 2.7–3.5 cm long, 0.4–0.6 cm broad, faces slightly cristate over the seeds, puberulent to short-pubescent. Seeds hardly flattened, 3.5–5.1 mm long, 0.8–1.4 mm broad.

Chromosome number: not determined.

Distribution: East-central Brazil, from southern Piauhí to Goiás and Minas Gerais. Habitats not known.



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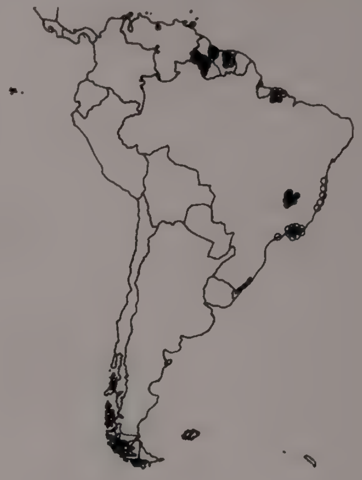

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FIG. 344. Map showing distribution of *C. curvifolia* var. *curvifolia* (closed circles), *C. curvifolia* var. *mollissima* (open square), and *C. curvifolia* var. *lucida* (crosses). FIG. 345. Map showing distribution of *C. ramosa* var. *ramosa*, typical form (closed circles), form with puberulent or pubescent stipules and leaflets (crosses), and *C. ramosa* var. *maritima* (open circles).

Except for its southernmost limit, the distribution of this little-known taxon is within that part of central Brazil which has received the least attention of botanists. Dimensionally, the foliar organs of *C. curvifolia* var. *mollissima* are rather intermediate to those of the typical variety and var. *lucida*.

The present author does not agree with Bentham's placement of *Gardner 2550* under the var. *lucida*, for in this collection the leaflets are very small, measuring only 2–4 mm in length, and, together with the young stems, stipules, pedicels, and sepals, bearing a distinctly puberulent vesture. Thus, the proper assignment of this collection would seem to be under *C. curvifolia* var. *mollissima*.

BRAZIL, GOIAS: Cavalcante, 1827–1828, *Burchell 7690* (K, photo NY). PIAUHI: District of Paranagoa?, Aug. 1839, *Gardner 2550* (BM).

8c. **Cassia curvifolia** var. **lucida** Bentham, *in* Mart. Fl. Bras. XV (II): 160. 1870. Photograph of isotypes examined (M): "In campis et pascuis Serro Frio, prov. Brasil. Minas." *Martius s.n.* w/o date (collected in Brazil 1817–1820).

Erect shrub or subshub, often much-branched, to 1.5 m tall. Stipules wholly or partly obscuring the glabrous or puberulent upper stem, broadly cordate-ovate, short-acuminate or mucronate, 0.4–1.1 cm long, 0.2–0.7 cm broad, glabrous and at least basally ciliolate to puberulent or short-pubescent. Petiole 1.5–5.0 mm long, puberulent to short-pubescent; rachis 0.3–1.0 as long as petiole. Gland 1, scutellate or urceolate to globular, 0.3–0.6 mm broad, sessile or on a short thick stipe to 0.5 mm high. Leaflets bijugate, the superior pair longer, joined to rachis by a small arcuate or semi-orbicular pulvinule 0.3–1.0 mm long, falcate-lanceolate or -oblanceolate to -obovate, glabrous and often nitid, ciliolate at least at the base, subcoriaceous or coriaceous, 0.4–1.6 cm long, 0.2–0.5 cm broad; apex obliquely rounded or obtuse to inflexed-acute. Flowers axillary, solitary; pedicels straight, finely pubescent, 0.7–1.1 cm long and ca. 0.3 mm thick in flower, up to 1.5 cm long and 0.7 mm thick in fruit; bracts 2, pubescent, suborbicular to broadly crescentiform, 0.1–0.4 mm high, 0.4–0.7 mm broad; bracteoles nearly or quite opposite, ovate to orbicular, 2.9–4.3 mm long, 2.5–3.8 mm broad; sepals lanceolate to narrowly ovate, puberulent without, glabrous within, ciliolate, 0.7–1.6 cm long, 0.3–0.7 cm broad; petals 1.2–1.7 cm long, 0.8–1.3 cm broad; ovary finely sericeous. Pod narrowly oblong, 2.9–3.5 cm long, 0.7–0.9 cm broad, sparsely appressed-pubescent to nearly glabrous. Seeds 9–15, little compressed, 3.2–5.2 mm long, 1.0–1.5 mm broad.

Distribution: East-central Brazil, from southern Pará to Goiás. Habitats not known.

This variety, scarcely better known than var. *mollissima,* is, on the basis of material available, very variable in the characters described for it by Bentham. But Bentham indicated his recognition of the fluidity of var. *lucida* by noting *Blanchet 3128* as intermediate between the 2 taxa. It should be stated here, however, that the var. *lucida* is retained in the present treatment more out of respect for Bentham and for the present author's ignorance of the *C. curvifolia* complex in the field than for any discrete taxonomic reasons.

Tamberlik s.n., a collection bearing no data other than "Pl. Bras. occid.," shows affinity to var. *lucida* in floral, fructal, and stipular characters, but has remarkably coriaceous, strongly veined, hyaline-margined leaflets which, excepting their obovate form and rounded apices, are very suggestive of *C. langsdorffii* var. *langsdorffii.* This collection is in fact a mixture, including *C. tagera,* a species of the section *Chamaecrista,* but which, owing to its wide distribution in Brazil, offers no clue as to the source of the other.

BRAZIL: w/o locality, w/o date, *Tamberlik s.n.* (NY). GOIAS: Cavalcanter, w/o date, *W. J. Burchell 7913* (K, P); w/o locality, w/o date, *W. J. Burchell 8256* (K); Between San Domingas and Passes (?), May 1840, *Gardner 4120* (BM, K, NY, S). PARA: Alto Tapajós, Rio Cururú, Missão, Campo da Tabua, 13 July 1959, *W. A. Egler 846* (MG); Rio São Manoel, Posto dos Indios Caiabí, 8 Jan. 1952, *J. M. Pires 3875* (NY).

9a. Cassia ramosa Vogel, Syn. Cass., p. 55, 1837. var. **ramosa.** Isotype examined (K): "Brasilia." *Sellow s.n.* w/o date probably 1814–1815).

Cassia uniflora Spreng. var. *ramosa* (Vog.) Benth., in Mart. Fl. Bras. XV (II): 158. 1870.
Cassia uniflora Spreng. var. *parvifolia* Benth., Trans. Linn. Soc. **27**: 568. 1871.
Cassia tetraphylla Desv. var. *ramosa* (Vog.) Amsh., On S. Am. Papilionaceae: 26. 1939.
Cassia uniflora Spreng. var. *utiarityi* Hoehne, Comm. Linh. Tel., Annex 5, Bot. pt. VIII: 47. 1919. Accompanying photograph of holotype examined: Brazil, Mato Grosso, "Rio Papagaio, near Salto Utiariti." *Hoehne 2075.* June 1909.
Cassia savannensis Miq., Ann. Nat. Hist., p. 15. 1843. Holotype examined (U): "Surinam, Joden savanna." *Focke 454.* w/o date (collected in Surinam 1835–1850). Amshoff's selection of the type of *C. savannensis* as that for *C. tetraphylla* var. *ramosa* is quite untenable, for Vogel's name, *C. ramosa,* based on a Sellowian

specimen from Brazil, was not only proposed before Miquel's *C. savannensis* but probably before Focke's Surinam materials had reached Europe.

Chamaecrista ramulosa Killip & Pittier, Bol. Soc. Venezolana Cienc. Nat. 7: 146. 1941. Type not seen: "Lomas de los Caños, valle del río Carí, al sur de El Tigre. Diciembre 15, 1940." *H. Pittier 14476.* Material (e.g. *L. H. & E. Z. Bailey 1378*) annotated by Britton as *Ch. rusbyi* Britt. & Rose was examined (NY). This latter name, while evidently not validly published, was treated by Killip and Pittier as a synonym of *Ch. ramulosa.* Characters given in the type description of *Ch. ramulosa* and material annotated as *Ch. rusbyi* clearly fall within the presently recognized range of variability of *Cassia ramosa.*

Erect shrub or subshrub, usually freely and often intricately branched, to 1.5 m tall. Stipules ovate-cordate, acuminate, 2.5–6.4 mm long, 1.5–3.4 mm broad, glabrous, occasionally puberulent or infrequently glaucous. Petiole 1.3–2.6 mm long, entirely glabrous or puberulent, the abaxial surface sometimes sparingly pilose; rachis about as long as petiole. Gland 1, rarely 2, usually urceolate but varying from scutellate to globular, 0.4–0.7 mm broad, elevated on a slender stipe 0.5–1.2 mm long. Leaflets bijugate, the pairs equal or the superior pair somewhat longer, joined to rachis by a small arcuate black or brown pulvinule 0.4–0.7 mm long, oblanceolate to obovate, often somewhat falcate, glabrous or sometimes puberulent, less commonly glaucous, firmly membranaceous, 0.3–1.2 cm long, 0.2–0.7 cm broad; apex obtuse or rounded. Flowers solitary or rarely in pairs, produced more or less continuously but most prolifically after rains; pedicels straight, glabrous, or unilaterally or completely puberulent, 1.4–2.3 cm long and ca. 0.4 mm thick in flower, up to 3.3 cm long and 0.8 mm thick in fruit; bracts 2, broadly ovate to orbicular, 0.6–1.1 mm long, 0.5–1.1 mm broad; bracteoles subopposite, lanceolate or narrowly ovate, glabrous or sometimes puberulent, 2.2–2.8 mm long, 0.8–1.4 mm broad; sepals lanceolate, mostly glabrous, 1.0–1.7 cm long, 0.3–0.5 cm broad; petals 1.7–2.6 cm long, 1.3–2.3 cm broad; ovary gray-sericeous. Pod narrowly oblong, 2.6–4.2 cm long, 0.4–0.6 cm broad, faces usually slightly sulcate between the seeds, sparsely pubescent to puberulent or glabrous. Seeds 15–22, somewhat compressed, 3.7–5.0 mm long, 1.0–1.7 mm broad.

Chromosome number: $n = 7$.

Distribution: southern Venezuela, eastward through British Guiana and Surinam to French Guiana, southward in Brazil through eastern Pará, Pernambuco, and Bahia to Minas Gerais, Goiás, and Mato Grosso. Occurring in savannas and open woods, chiefly on sandy soils, from sea level to 3500 feet (up to 5000 feet in the vicinity of Mount Roraima).

Although the distribution map of *C. ramosa* var. *ramosa* would seem to indicate a high degree of localization, it is probable that future collections from the Rio Brânco area of Brazil, Rupununi district of British Guiana, Amapá, much of the southern drainage of the Amazon, and the northeastern states of Brazil, will include material of this taxon. Despite its already known wide dispersal, a remarkable degree of morphological stability is shown. However, material from littoral areas is distinctive in habit as well as in foliar details, and, because of the likelihood of maritime selection having had influence in the expression of these characters, this material has been segregated as var. *maritima* Irwin.

Another variable character, that of vesture of pedicels and leaflets, shows as yet, little correlation with geography, and hence, puberulent or pubescent specimens are not given nomenclatural recognition. While glabrous plants are common over the entire range, in Surinam and British Guiana approximately one-third of the collections which have been examined display puberulent or pubescent pedicels. However, this character also appears, rather less commonly, not only in adjacent Venezuela but far to the south in Pernambuco, Bahia, and Minas Gerais. Puberulent or pubescent leaflets, a condition always accompanied by similar vesture of pedicels, occurs in the Gran Sabana of Venezuela and in inland areas of Bahia. Conspicuous glaucescence of leaflets is found in the Gran Sabana and in central Minas Gerais, but, as far as is known, nowhere in between. Until the savannahs in the north and south drainage of the lower Amazon become better known botanically, it would seem best to regard these variants as unnamed local forms. In the present treatment, the conception of *C. ramosa* includes the vestural and dimensional extremes elucidated by Miquel (1850).

Bentham's transfer of *C. ramosa* to varietal status under *C. uniflora* Spreng. (= *C. chartacea* Irwin) was plausible at the time of his work, but in view of the presently known wide dispersal of this taxon, its relative stability, and its clear distinction from *C. chartacea,* on the basis of the stipitate glands, small bracteoles, and large corolla, its reinstatement at specific rank seems more consistent with the treatment accorded other taxa in the section. The varietal epithet, *parvifolia,* was an arbitrary name change by Bentham, presumably made in the interest of etymological clarity (*C. chartacea* itself is also quite ramose), but lacking legitimacy under the present code (Lanjouw et al., 1956).

Amshoff's transfer of *C. ramosa* to varietal rank under *C. tetraphylla* Desv. was an expression of her opinion that all bijugate taxa in the section *Xerocalyx* were probably varieties of a single variable species. As will be shown, variability in *C. tetraphylla* is indeed considerable, but does not tend in the direction of characters displayed by *C. ramosa.*

C. uniflora var. *utiarityi* is, as Hoehne states, distinct only in its erect habit and general pubescence. However, neither character is sufficiently stable to warrant recognition, at least until this presumed segregate and the area from which it was taken become better known.

BRAZIL: w/o locality, w/o date, *Herb. Martius 405* (BM, F, GH, K, MO, NY, P, US): BAHIA: In Brasiliae provincia Bahia, 1839, *Blanchet 653* (BM); Bahia, Sept. 1837, *Gardner 888* (BM); Bahia, w/o date, *Glocker 155* (BM, K); Itapoan?, Lagôa de Abaite, 2 Sept. 1956, *E. Pereira 1972* (F); Ilha de Itaparica, 15 July 1951, *J. M. Pires 3427* (NY); Bahia, w/o date, *Salzmann s.n.* (K, MO, P); Bahia, w/o date, *Wetherell s.n.* (K): GOIAS: w/o locality, (Goiás?), w/o date, *Glaziou 19088* (GH, NY, UC): Goyaz, w/o date, *Glaziou 20990* in part (UC, US); Serra da Christaes, 1837, *Pohl s.n.* (K); Salinas, Goyaz, May-July 1844, *M. A. Weddell 2048* (P): MINAS GERAIS: Minas Geraes, w/o date, *Glaziou 19091* (NY, P); Minas Geraes, 1892, *Glaziou 19092* (MG, US); Serra do Cipó, 55 km; of Morro do Pilar on road to S. José do Almeido, 73 Jan. 1959, *H. S. Irwin 2445* (MICH, NY, R, TEX, UC, US, VIC); 16 km N of Diamantina on old road to Mendanha, 17 Jan. 1959, *H. S. Irwin 2469* (MICH, NY, R, TEX, UC, US, VIC); 16 km N of Diamantina on old road to Mendanha, 17 Jan. 1959, *H. S. Irwin 2469a* (MICH, NY, R, TEX, UC, US, VIC); 20 km N of Diamantina on old road to Mendanha, 17 Jan. 1959, *H. S. Irwin 2474* (MICH, NY, R, TEX, UC, US, VIC); Serra do Cipó, km 140, estrado do Pilar, 11 Jan. 1934, *Mello Barreto 5943* (F);

Arranca Rabo, Diamantina, 3 Oct. 1937, *Mello Barreto 9423* (F); Guinda, Diamantina, 5 Nov. 1937, *Mello Barreto 9403* (F); Above Corriga Duas Pontes, Distr. Diamantina, 13 May 1931, *Y. Mexia 5828* (BM, F, GH, MICH, NY, MO, S, U, UC, US) ; Serra da Lapa, Dec. 1824, *Riedel 1105* (US); Serra da Pedra Redonda, 4 km W of Sêrro, Municipio of Sêrro, 3 May 1945, *L. O. Williams* & *V. Assis 6917* (GH, US): PARA: Alto Tapajós, Rio Cururú, Missão Velha, 20 July 1959, *W. A. Egler 1049a* (MG). PERNAMBUCO: Campestre, Itapissuma, 1887, *Ridley, Lea,* & *Ramage s.n.* (BM).

BRITISH GUIANA: Along the Berbice-Rupununi Cattle Trail, Berbice or Demerara Co., 24 Feb. 1919, *A. A. Abraham 1* (NY); Near Hariwa Quarry, 32 miles S of Mackenzie, 18 Jan. 1955, *R. S. Cowan 39278* (F, NY, US) ; Orealla Savannah, 1 mile W of Orealla, Courantyne R., Berbice, 4 Jan. 1955, *H. S. Irwin 578* (TEX) ; Mypoora, Courantyne River, Nov. 1879, *G. S. Jenman 998* (K); Berbice River, March 1882, *G. S. Jenman 1681* (NY); Quimatta, Rupununi River, Oct. 1888, *G. S. Jenman 5168* (K, NY): Quimatta, Rupununi River, Oct. 1889, *G. S. Jenman 5514* (BM, K, U); Waranama Ranch, Wiruni-Ituni Savannahs, Sept. 1929, *Martyn 134* (NY); Kotinga Valley, near Roraima, Autumn 1894, *J. J. Quelch* & *F. McConnell 133* (K); Guiana angl., w/o date, *Rich. Schomburgk s.n.* (P, U); Sandy savannahs on the upper Rupununi, *Robt. Schomburgk 20S* (K); w/o locality, 1837, *Robt. Schomburgk 190* (BM, F, K, MICH, US); Roraima, 1842–3, *Robt. Schomburgk 553=Rich. Schomburgk 890* (BM, K); Frechal, Mount Roraima and vicinity, 8 Sept. 1927, *G. H. H. Tate 50* (NY).

FRENCH GUIANA: Savannah west of Cayenne, 26 Oct. 1954, *R. S. Cowan* & *B. Maguire 38010* (NY) .

SURINAM: Zanderij I, 14–25 Nov. 1934, *W. A. Archer 2739* (U, US) ; w/o locality, 1841, *M. Berthoud-Coulon 154* (BM, MO, NY); Patricksavanne, Oct. 1909, *I. Boldingh 3889* (U); Matta-savanne, 28 July 1952, *J. G. P. Dirven 276* LP (U); Zanderij I, 22 Dec. 1950, *J. Florschütz* & *P. A. Florschütz 813* (NY, U): In Surinam savannis, 1850, *Focke–Miquel s.n.* (K, U) ; Zanderij I, 10 Aug. 1909, *Gonggrijp 417* (U) ; w/o locality (Surinam) , w/o date, *Hostmann 808* (BM, NY, U); Vicinity of Sectie O, Nov. 1941, *B. A. Krukoff 12317* (GH, NY) ; Prope Republiek, 16 Oct. 1911, *J. Kuyper 97* (U) ; Sectie O, 22 July 1933, *J. Lanjouw 154* (NY, U); Grote Sapende-savanne, 8 Feb. 1949, *J. Lanjouw* & *J. C. Lindeman H41* (U); Zanderij I, 4 Sept. 1940, *J. Lanjouw* & *J. C. Lindeman 166* (NY, U); Zanderij I, savanna near the aerodrome, 9 Sept. 1940, *J. Lanjouw* & *J. C. Lindeman 236* (NY, U); Via secta ab Moengo tapoe ad Grote Zwiebelzwamp, 22 Oct. 1948, *J. Lanjouw* & *J. C. Lindeman 959* (NY, U); Joden savanna, 12 Apr. 1949, *J. Lanjouw* & *J. C. Lindeman 2993* (NY, U): Jodensavanne–Mapane kreek area (Suriname R.), 14 May 1953, *J. C. Lindeman 3961* (U); Jodensavanne–Mapane kreek area (Suriname R.), 10 July 1953, *J. C. Lindeman 4197* (U); Sectie O, 8 Mar. 1920, *A. Pulle 149* (U, US) ; Forest of Zandery, 31 May 1916, *J. A. Samuels 480* (GH, MO, NY, UC); Onobissi, Coppename R., 4 Mar. 1915, *Stahel* & *Gonggrijp 1124a* (U); Savanna II, Zanderij, 3 June 1944, *G. Stahel* & *B. Maguire 23657* (F, NY, U, US); South savannas, vicinity of Arawak village of Mata, 18 Oct. 1944, *G. Stahel* & *B. Maguire 24959* (F, GH, NY, U, US); Savanne Kompas, Sept. 1901, *Went 368* (U).

VENEZUELA: Ciudad Bolivar and vicinity, 20 Dec. 1920 (?), *L. H.* & *E. Z. Bailey 1378* (NY); Alto Caroni, alrededores de Sta. Elena de Uairen, 19 Apr. 1946, *T. Lasser 1324* (NY); Caracas, w/o date, *Lockhart s.n.* (K); Between Upata and Río Caroni, Bolívar, 2 Aug. 1944, *J. A. Steyermark 57626* (F, MO); Between Kun and waterfall at Rué–merú (tributary of Río Kukenán), south of Mount Roraima, Bolívar, 2 Oct. 1944, *J. A. Steyermark 59170* (F, MO) ; Gran Sabana, between waterfall at Rué–merú (tributary of Río Kukenán) and Divina Pastora on Río Kukenán north of Santa Elena, south of Mount Roraima, Bolívar, 3 Oct. 1944, *J. A. Steyermark 59211* (F, MO); Gran Sabana, Sta. Elena, Bolívar, Feb. 1946, *F. Tamayo 2986* (US) Río Gargueni, Bolívar, 11 Dec. 1955, *J. J. Wurdack* & *J. V. Monachino 39793* (F, NY, US); Piedre Marimare, east bank of Río Orinoco opposite head of Isla El Gallo, 20 Dec. 1955, *J. J. Wurdack* & *J. V. Monachino 40853* (MO, NY, U, UC).

9b. Cassia ramosa var. maritima Irwin, var. nov.

Holotype (NY): Brazil, Guanabara, "Vicinity of Cabo Frio." *J. N. Rose & P. G. Russell 20688.* 8 Aug. 1915. Isotype (US).

Planta suffruticosa aut fruticosa, decumbens aut suberecta, ad 1 m alt., plerumque ramosissima. Stipulae adpressae, persistentes, late lanceolato- ad ovato-cordatae, acutae acuminataeve, 4.2–7.3 mm long., 1.9–4.9 mm lat., glabrae aut interdum puberulentes, integrae vetustiores saepe erosae cinereaeque. Petiolus 1.3–3.7 mm long., puberulens; rachis aeque longa ac petiolus aut aliquanto brevior, terminaliter aristulata. Glans 1, urceolata scutellatave, 0.2–0.5 mm lat., subsessilis aut in stipite tenui usque ad 0.6 mm long. elevata. Foliola bijugata, paribus subaequis aut pari superiore longiore, per pulvinulum parvum arcuatum atrum brunneumve 0.3–0.6 mm long., sessilia, oblanceolata ad obovata, recta ad basim obliqua, glabra aut interdum puberulentia aut velveto-pubescentia, firme membranacea, 0.7–1.5 cm long., 1.7–4.5 mm lat.; margines integri, apice obtuso rotundatove. Flores axillares singulares aut raro binae; pedicelli recti aut sursum leviter arcuati, glabri aut puberulentes, 1.6–3.3 cm long., c. 0.3 mm crass. dum florentes, usque ad 4.0 cm long., 0.6 mm crass. dum frugiferentes; bracteae 2. late ovatae ad orbiculares, 0.7–1.2 mm long., 0.5–1.0 mm lat.; bracteolae suboppositae, lanceolatae aut anguste ovatae, glabrae puberulentesve, 1.0–1.8 cm long., 0.4–0.6 cm lat.; petala flava, 1.8–2.5 cm long., 1.4–2.3 cm lat.; stamina flava; ovarium cinereo-puberulens ad -sericeum. Siliqua anguste oblonga, 2.5–4.0 cm long., 0.4–0.6 cm lat.; superficies super semina quasi cristata, parce pubescens puberulensve ad glabram. Semina 9–16, levia dura atro-brunnea aut atra, satis complanata, 4.0–5.4 mm long., 1.0–1.9 mm lat.

Decumbent or suberect subshrub or shrub to 1 m, usually much-branched. Stipules broadly lanceolate- to ovate-cordate, acute or acuminate, 4.2–7.3 mm long, 1.9–4.9 mm broad, glabrous or occasionally puberulent, often becoming erose and gray with age. Petiole 1.3–3.7 mm long, puberulent; rachis about as long as petiole or somewhat shorter. Gland 1, urceolate or scutellate, 0.2–0.5 mm broad, subsessile or elevated on a slender stipe up to 0.6 mm long. Leaflets bijugate, the pairs subequal or the superior pair longer, joined to rachis by a small arcuate black or brown pulvinule 0.3–0.6 mm long, oblanceolate to obovate, straight, oblique at base, glabrous or sometimes puberulent or velvety-pubescent, firmly membranaceous, 0.7–1.5 cm long, 1.7–4.5 mm broad; apex obtuse or rounded. Flowers solitary or rarely in pairs; pedicels straight or arching gently upward, glabrous or puberulent, 1.6–3.3 cm long and ca. 0.3 mm thick in flower, up to 4.0 cm long and 0.6 mm thick in fruit; bracts 2, broadly ovate to orbicular, 0.7–1.2 mm long, 0.5–1.0 mm broad; bracteoles subopposite, lanceolate or narrowly ovate, glabrous or puberulent, 2.3–3.1 mm long, 0.9–1.6 mm broad; sepals lanceolate, glabrous or externally puberulent, 1.0–1.8 cm long, 0.4–0.6 cm broad; petals 1.8–2.5 cm long, 1.4–2.3 cm broad; ovary gray-puberulent to -sericeous. Pod narrowly oblong, 2.5–4.0 cm long, 0.4–0.6 cm broad, faces slightly sulcate between the seeds, sparsely pubescent or puberulent to glabrate. Seeds 9–16, somewhat flattened, 4.0–5.4 mm long, 1.0–1.9 mm, broad.

Chromosome number: not determined.

Distribution: Coastal Brazil, in Pará, Rio Grande do Norte, Pernambuco, Bahia, and Rio de Janeiro. Occurring in beach dunes and restingas in white or gray sand.

It is not yet clear whether this taxon has a continuous range from the Amazon to

Rio de Janeiro or whether, as in *C. tetraphylla* Desv. var. *littoralis* Irwin, there are numerous isolated populations. Variability over the total geographical range is slight, but the following deviations may be noted: several collections from the vicinity of Rio de Janeiro (e.g. *Segadas-Vianna 3586*), one from Rio Grande do Norte (*Wurdack B-85*), and a few from Pará (e.g. *Ducke 2055*), have puberulent to velvety-pubescent stipules and leaflets; *Ule 7379,* from Bahia, has rather thick leaflets ca. 5 mm broad and stipules nearly 9 mm long, these characters suggesting an approach to *C. paiuhiensis.*

Contiguity of the range of this variety with that of *C. ramosa* var. *ramosa* is known to exist only in Pará. Southward from Bahia there is, as is described in connection with *C. tetraphylla* var. *littoralis,* a geographical and biotic barrier separating coastal populations of *C. ramosa* var. *maritima* from the nearest inland populations of *C. ramosa* var. *ramosa.*

This taxon is distinguished from the typical variety not only by its lower, more diffuse habit, but also by the larger stipules and leaflets, and by the smaller glands.

BRAZIL: Brasilia, w/o date, *Riedel 739* (K). BAHIA: w/o locality (Bahia), w/o date, *Lockhart s.n.* (BM); Taboleiro bei Romanso, Jan. 1907, *Ule 7379* (K). PARA: Rio Guajará, campina, 14 May 1954, *G. A. Black 54–16148* (US); Ilha de Colares, Municipio da Vigia, 29 Sept. 1954, *G. A. Black 54–16895* (NY, UC); Marapanim, Marudasinho, práia, 2 July 1958, *P. B. Cavalcante 432* (MG); Salinas, práia Junto do Mangue, 15 Dec. 1944, *A. Ducke 2055* (U); Vigia, 28 June 1927, *A. Ducke 20335* (S, U, US); Salinas, Nov. 1917, *J. Simão da Costa 16827* (MG); Between Belém and Val de Cans airfield, near "Bosque," 25 Aug. 1946, *J. J. Wurdack B-117* (NY). PERNAMBUCO: w/o locality (Pernambuco), Nov. 1837, *Gardner 988* (BM, K, NY, S, US); Restinga Piedade, 14 June 1950, *G. G. Leal* & *O. A. da Silva 66* (MO). RIO DE JANEIRO: Recreio dos Bandeirantes, D. F., 22 Oct. 1938, *Alston* & *Lutz 150* (BM, U); Rio de Janeiro prope urbem, loco Praia do Pinto, July 1916, *A. Frazão 7507* (S, U); w/o locality (prov. of Rio de Janeiro), w/o date, *A. Glaziou 1378* (BM); Restinga de Tijuca, 2 Jan. 1876, *A. Glaziou 6181,* in part (BM, MG, S); Restinga de Tijuca, Nov. 1879, *A. Glaziou 10658* (S); Restinga, Ipanema, 16 July 1957, *J. W. Harshberger 836* (US); Praia de Leblond, 16 June 1901, *E. Hemmendorff 395* (S); Recreio de Bandeirantes, Mar. 1931, *B. Lutz 605* (US); Road between Araruam lagoon and the main road Cabo Frio-Arraial do Cabo, Cabo Frio Co., 17 Aug. 1953, *F. Segadas-Vianna, L. Dau, W. T. Ormond, G. C. Machline,* & *J. Loredo Jr. 540* (TEX); Pontal Beach, Arraial do Cabo, Cabo Frio Co., 1953, *F. Segadas-Vianna, L. Dau, W. T. Ormond, G. C. Machline,* & *J. Loredo Jr. 552* (TEX); Pontal Beach, Arraial do Cabo, Cabo Frio Co., 1953, *F. Segadas-Vianna, L. Dau, W. T. Ormond, G. C. Machline,* & *J. Loredo Jr. 1375* (TEX); Restinga de Itapeba (Recreio dos Bandeirantes), ao nivel do mar, 29 Oct. 1950, *F. Segadas-Vianna 3585* (TEX); Restinga de Itapeba (Recreio dos Bandeirantes), ao nivel do mar, 1 Oct. 1950, *F. Segadas-Vianna 3586* (TEX); Arraial do Cabo, Cabo Frio Co., Feb.–Mar. 1951, *F. Segadas-Vianna 4149* (TEX); Pontal Beach, Arraial do Cabo, Cabo Frio Co., Feb–Mar. 1951, *F. Segadus-Vianna 4150* (TEX); Praia de Sernambetiba (Recreio dos Bandeirantes), 4 Apr. 1952, *L. B. Smith, F. Segadas-Vianna, S. L. Oliveira e Silva, A. Magnanini, L. Dau, Z. Lopes da Silva, W. T. Ormond,* & *G. C. Machline 6423* (SI, US); Near Rio de Janeiro, 1838–1842, *Wilkes 265* (GH, NY, US). RIO GRANDE DO NORTE: Between Parnamirím airfield and Rio Cajupiranga, south of Natal, 11 Aug. 1946, *J. J. Wurdack B-85* (NY).

10a. Cassia chartacea Irwin, sp. nov. var. **chartacea.** Holotype (M): "Brasil." *Martius 1076.* w/o date (collected in Brazil 1817–1820). Isotypes (BM, K, MO, NY, S).

Cassia Uniflora Spreng. var. *latifolia* Benth., in Mart. Fl. Bras. XV. (II): 158. 1870. Non *C. latifolia* G. W. Mey. Photograph of holotype examined (M): Brazil, Bahia, "in campis mediterraneis Bahiensis." *Martius s.n.* w/o date (collected in Brazil 1817–1820).

Planta fruticosa aut suffruticosa erecta, plerumque ramosissima, ad 1.5 m alt. Caules puberulentes aut iuvenes pubescentes. Stipulae adpressae persistentes, caulem superiorem partim celantes, lanceolato-cordatae aut anguste ovato-cordatae, longo-acutae aut -acuminatae, 6.1–9.0 mm long., 2.0–3.1 mm lat., glabrae, saepe quasi glaucae, ciliolatae integrae. Petiolus tenuis, 4.2–6.0 mm long., canaliculo adaxiali puberulente, superficie abaxiali pubescente aut pilosa pilis distaliter directis; rachis 0.3–0.5 brevior quam petiolus, saepe sursum arcuata, terminaliter aristata. Glans 1, plerumque scutellata, 0.2–0.4 mm lat., sessilis, saepe depressa atque non perspicua. Foliola bijugata, raro trijugata, paribus subaequis aut pari superiore paululum longiore, per pulvinulum parvum arcuatum atrum aut brunneum aut subflavum 0.2–0.5 mm long. sessilia, oblanceolata, paululum obliqua, recta aut laminae superiores interdum divergentes, glabrae saepe glaucae, membranaceae papyriferaeve, 1.2–2.5 cm long., 0.3–0.5 cm lat., cinereo-virides; margines integri ad apicem rotundatum obtusumve saepe ciliolati. Flores axillares, plerumque singulares; pedicelli recti, unilateraliter aut omnino puberulentes, 1.6–2.1 cm long., c. 0.3 mm crass. dum florentes, usque ad 2.8 cm long., 0.5 mm crass. dum frugiferentes; bracteae 2, lanceolatae ad ovatae, 2.0–3.1 mm long., 0.7–1.4 mm lat.; bracteolae suboppositae, lanceolatae, 3.9–5.1 mm long., 1.2–1.4 mm lat., sepala lanceolata aut anguste ovata, glabra, 1.0–1.4 cm long., 2.7–3.4 mm lat.; petala dilute flava, vexillo maculam subroseam interdum praebente (e.g. *Irwin 2420*), 1.2–1.6 cm long., 0.9–1.4 cm lat.; stamina flava aut straminea; ovarium flavum aut cinereo-pilosum. Siliqua anguste oblonga, 2.7–3.4 cm long., 4.5–5.7 mm lat., plana aut quasi plana, parce adpresso-pilosa. Semina 10–15 levia dura brunnea atrave, paululum compressa, 3.0–4.2 mm long., 0.7–1.2 mm lat.

Erect shrub or subshrub, usually much-branched, to 1.5 m. Stems puberulent or pubescent when young. Stipules partly obscuring upper stem, lanceolate-cordate or narrowly ovate-cordate, long-acute or -acuminate, 6.1–9.0 mm long, 2.0–3.1 mm broad, glabrous, often somewhat glaucous, ciliolate. Petiole slender, 4.2–6.0 mm long, the adaxial groove puberulent, the abaxial surface pubescent or pilose with distally-directed hairs; rachis 0.3–0.5 as long as petiole, often arched upward. Gland 1, usually scutellate, 0.2–0.4 mm broad, sessile, often depressed and obscure. Leaflets bijugate, rarely trijugate, the pairs subequal or the superior pair slightly longer, joined to rachis by a small arcuate black, brown or yellowish pulvinule 0.2–0.5 mm long, oblanceolate, slightly oblique, straight or the superior blades occasionally divergent, glabrous, often glaucous, membranaceous or papyriferous, 1.2–2.5 cm long, 0.3–0.5 cm broad, gray-green; margins frequently ciliolate at the rounded or obtuse apex. Flowers usually solitary; pedicels straight, somewhat flattened, unilaterally or wholly puberulent, 1.6–2.1 cm long and ca. 0.3 mm thick in flower, up to 2.8 cm long and 0.5 mm thick in fruit; bracts 2, lanceolate to ovate, 2.0–3.1 mm long, 0.7–1.4 mm broad; bracteoles subopposite, lanceolate, 3.9–5.1 mm long, 1.2–

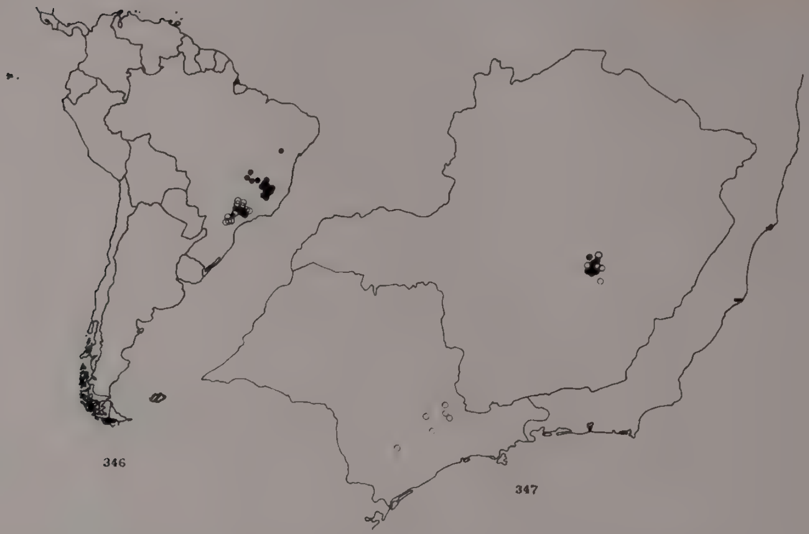

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FIG. 346. Map showing distribution of *C. chartacea* var. *chartacea* (closed circles) and *C. chartacea* var. *tenuicaulis* (open circles). FIG. 347. Map of East-central Brazil showing distribution of *C. malacophylla* (closed circles) and *C. tecta* (open circles).

1.4 mm broad; sepals lanceolate or narrowly ovate, glabrous, 1.0–1.4 cm long, 2.7–3.4 mm broad; petals 1.2–1.6 cm long, 0.9–1.4 cm broad, the banner occasionally with a pink blotch (e.g. *Irwin 2420*); ovary yellow- or gray-pilose. Pod narrowly oblong, 2.7–3.4 cm long, 4.5–5.7 mm broad, flat or nearly so, sparsely appressed-pilose. Seeds 10–15, slightly compressed, 4.0–4.2 mm long, 0.7–1.2 mm broad.

Chromosome number: not determined.

Distribution: Brazil, central and western Minas Gerais and southern Goiás south to central and western São Paulo. Possibly also in western Pernambuco and in central Paraná. Occurring in rocky and sandy hills and savannas, from 750 to 3000 feet elevation.

Cassia chartacea, named for the unusually thin and obscurely veined leaflets, is based on a number of collections, showing considerable homogeneity in the typical variety, which were first recognized by inference as a taxonomic entity by Bentham. However, in his treatment of *Cassia* in Flora Brasiliensis, Bentham, who cited *Martius 1076* under *C. uniflora,*[14] evidently adopted a different concept of that species than was intended by Sprengel. This is clear from Sprengel's type description of *C. uniflora* Spreng., in which *C. lanceolata* Pers., while listed as a possible synonym, is later in the same description regarded as agreeing with *C. uniflora* in all details save those of the stipules. However, the type of *C. lanceolata* clearly agrees with *C. tetraphylla* Desv. var. *brevipes* (Benth.) Irwin. Colladon's (1816) type description of *C. persoonii* similarly treats *C. lanceolata* as a synonym.

In his monograph of the genus (1871), Bentham placed *C. lanceolata* and *C. persoonii* in synonymy under *C. uniflora,* but without having seen the types for any of the 3 names. Thus, it is clear that Bentham's concept of *C. uniflora* was not gained as a result of critical study of specimens but rather from the wholly inadequate diagnoses of the authors mentioned. It is clear that *C. uniflora* and *C. persoonii* are based on the Lamarckian specimen which typifies *C. lanceolata;* because the last, clearly part of the *C. tetraphylla* complex, has been treated as a synonym of *C. uniflora* and *C. persoonii,* the material at hand requires separate documentation as *C. chartacea.*

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[14] *C. uniflora* Spreng. Neue Entd. I:291. 1820, invalidated by the earlier homonym *C. uniflora* Mill. Gard. Dict. ed. VIII, n. 5, 1768 (sect. *Prososperma*), has more recently been called *C. persoonii* Collad. Hist. Cass. 119. 1816.

Careful study of material assignable to *C. chartacea* has shown that in 3 areas in Minas Gerais and southern Goiás characters of this species tend to approach those of *C. langsdorffii* Kunth var. *parvifoliola* Irwin. In specimens from the first of these areas, southern Serra do Espinhaço, from Serra do Cipó northward to the vicinity of Diamantina, leaflets are often smaller, more apiculate, firmly membranaceous or subcoriaceous, the pedicels up to 0.7 mm thick in fruit, and the petiolar gland frequently long and somewhat stipitate. Material from the mountains immediately east of Belo Horizonte, i.e. from Itabirito to Ouro Preto, differs from the more northerly variant in having leaflets more nearly the size of those in the typical *C. chartacea,* but with longer stipules, very like those of *C. langsdorffii* var. *parvifoliola.* The third "region" is much less well defined and, judging from the few specimens now available, may not be a discrete region but simply a collection of isolated localities where sympatric hybridization and consequent introgression has occurred. These variants, from western Minas Gerais (Patos de Minas, Serra do Caracól) and southern Goiás (Chapada dos Veadeiros), are similar in having even larger stipules, i.e. up to 1.4 cm long, unilaterally puberulent pedicels about as long as the stipules in fruit, and subsessile petiolar glands ca. 0.5 mm broad. Although both *C. langsdorffii* var. *parvifoliola* and the typical *C. chartacea* are sympatric in São Paulo, there are no known intergrades from that state. However, in lieu of actual field knowledge of the populations from which the above described specimens were obtained, it is felt that formal recognition should be deferred until the central Brazilian region becomes better known.

A fourth variant, found on the savannas of Bahia, Minas Gerais, São Paulo, and Paraná, is distinctive in its low, decumbent, ramose habit, its smaller but still membranaceous leaflets, and its narrower stipules. Because the taxonomy of the *Xerocalyx* species is relatively uncomplicated south of Minas Gerais and because of the apparent stability of this variant, it will be dealt with separately as *C. chartacea* var. *tenuicaulis* Irwin.

C. uniflora var. *latifolia* Benth., with larger foliar structures and corollas approaching those of *C. tetraphylla* in size, resembles typical material of *C. chartacea* in other respects, and is therefore included here.

BRAZIL, GOIAS: 20 km N of São João da Allianca, 13 Apr. 1956, *E. Y. Dawson 14160* (NY); Vargem Grande in Chapadão dos Veadeiras, w/o date, *Glaziou 20990*[15] (MG, P, S in part, UC in part, US in part): MINAS GERAIS: Caxoeiras do Campos, 1839, *Claussen* (&

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[15] *Glaziou 20990* illustrates the transition from an extreme form of *C. chartacea* var. *chartacea* to *C. langsdorffii* var. *langsdorffii* very clearly. Unfortunately, each herbarium to which duplicate material was distributed has one or two phases in the total intergradation. Determination of the material under this number, in addition to that cited above, is as follows: *C. langsdorffii* var. *parvifoliola*: S in part, UC in part, US in part; *C. langsdorffii* var. *langsdorffii*: BM, S in part. Material at K and NY is rather intermediate between C. *langsdorffii* var. *parvifoliola* and var. *langsdorffii,* but is closer to the latter taxon.

Delessert?) s.n. (K) ; w/o locality, 1840, *Claussen s.n.* (BM) ; w/o locality, *Claussen 1* (F, GH, MICH) ; w/o locality, w/o date, *Claussen 80* (F) ; Serra da Caracól, 10 Feb. 1874, *Gillosin 1247* (S); Environs de Rio Janeiro et d'Ouro Preto, 1883–1884, *A. Glaziou 14531* (K); w/o locality, w/o date, *A. Glaziou 19088* (NY); Poços de Caldas, 27 Jan. 1919, *F. C. Hoehne 2922* (BM) ; Lagôa Seca, Serra do Curral, Município de Belo Horizonte, 2 Jan. 1959, *H. S. Irwin 2364a* (TEX) ; Lagôa Seca, Serra do Curral, Município de Belo Horizonte, 2 Jan. 1959, *H. S. Irwin 2365* (MICH, NY, R, TEX, UC, US, VIC); Serra Rola Moça, ca. 10 km E of Barreiro, Município de Contagém, 7 Jan. 1959, *H. S. Irwin 2390* (MICH, NY, R, TEX, UC, US, VIC); Serra do Itabirito, 5 km W of Cachoeira do Campo, 11 Jan. 1959, *H. S. Irwin 2420* (MICH, NY, R, TEX, UC, US, VIC); 41 km S of Carmo de Paranaiba, on rd. to Rio Paranaiba, 10 Feb. 1959, *H. S. Irwin 2617* (MICH, NY, R, TEX, UC, US, VIC); Ponte Queimada—Extraccão, Diamantina, 19 Nov. 1937, *Mello Barretto 9847* (F, US); Caldas, Pedra Blanca, 9 May 1862, *Regnell II 74* (S); Caldas 19 Jan. 1865, *Regnell II 74* (K, NY, S, US); Serra de Caldas, 1875, *Regnell II 74* (S): w/o locality, w/o date, *Regnell II 74c* (S); w/o locality, 1845, *Widgren s.n.* (S, U); Serra da Mutuca, hills near Lagôa Seca, near Belo Horizonte, 22 Feb. 1945, *L. O. Williams & Assis 5589* (GH); Serra da Mutuca, Município of Nova Lima, Feb. 1945, *L. O. Williams 5693* (GH) ; In campo, Bento Pires, Belo Horizonte, 13 Mar. 1945, *L. O. Williams & V. Assis 5940* (US); Morro das Pedras, near Belo Horizonte, 4 Mar. 1945, *L. O. Williams & Assis 5981* (F, GH); Near Lagôa Pampulha, Município of Belo Horizonte, 8 Mar. 1945, *L. O. Williams & F. Assis 6079* (GH, MO, SI, UC). PARANA: Caiobá, 30 June 1944, *R. Hertel 1820* (S). SAO PAULO: Villa Prudente, Dec. 1917, *H. Leuderweldt 1003* (GH, NY); In campis inter St. Paulo et Jaguary, Jan. 1834, *Riedel s.n.* (US); In campis Ytú, Feb. 1834, *Riedel & Luschnatt 2028* (GH, NY, US).

10b. Cassia chartacea var. **tenuicaulis** Irwin, var. nov.

Holotype (US): Brazil, São Paulo, "in campis arenosis, Araracoara." *Riedel 2198.* The label of the type specimen bears the date 1834, but since Riedel ceased collecting in Brazil in 1825, it is believed that the correct date is 1824.

Planta decumbens ramosior suffruticosa aut fruticosa ad 0.5 m alt., saepe penicillatim fasciculata ad 1 m lat. Caules tenues, iuvenes saepe flexui glabri puberulentesve. Stipulae adpressae persistentes lanceolato-cordatae, longo-acutae aut -acuminatae, 2.1–6.8 mm long., 1.1–1.9 mm lat., glabrae, ad basim interdum ciliolatae, integrae. Petioli tenues, 1.1–2.3 mm long., canaliculo adaxiali puberulente, superficie abaxiali glabra puberulenteve, raro brevi-pilosa; rachis aeque longa ac petiolus aut 0.5 brevior, interdum sursum arcuata, terminaliter aristulata. Glans 1 plerumque scutellata, 0.2–0.4 mm lat., sessilis subsessilisve, raro brevi-stipitata, interdum depressa et non perspicua. Foliola bijugata, pari superiore plerumque longiore, per pulvinulum minutum arcuatum atrum brunneumve sessilia, lanceolato- aut oblanceolato-oblonga, paululum obliqua, recta aut laminis superioribus divergentibus, glabra membranacea papyriferave, 0.4–1.4 cm long., 2.1–3.1 mm lat., saepe cinereo-viridia; margines integri, apice obtuso rotundatove. Flores axillares plerumque singulares; pedicelli recti glabri aut rarius in linea puberulentes, 1.5–2.8 cm long., c. 0.3 mm crass. dum florentes, usque ad 3.7 cm long., 0.5 mm crass. dum frugiferentes; bracteae 2, lanceolatae aut anguste ovatae, 1.5–1.9 mm longae, 0.5–0.9 mm lat.; bracteolae suboppositae remotaeve, lanceolatae, 1.7–2.3 mm long., 0.6–1.1 mm lat.; sepala lanceolata 7.8–11.0 mm long., 2.1–2.6 mm lat.; petala flava, 8.9–13.5 mm long., 7.0–10.7 mm lat.; stamina flava; ovarium in margine aut omnino breve cinereo-pilosum. Siliqua anguste oblonga, 1.8–3.1 cm long.; 0.4–0.6 cm lat., plana aut quasi plana, in suturis glabra aut parce puberulens. Semina 8–14, levia dura brunnea atrave, paululum compressa 3.2–4.7 mm long., 0.7–1.2 mm lat.

Decumbent, freely-branched subshrub or shrub to 0.5 m, frequently forming tufted clumps up to 1 m broad. Stems slender, often flexuous when young, glabrous or puberulent. Stipules lanceolate-cordate, long-acute or -acuminate, 2.1–6.8 mm long, 1.1–1.9 mm broad, glabrous, occasionally ciliolate at base. Petioles slender, 1.1–2.3 mm long, the adaxial groove puberulent, the abaxial surface glabrous or puberulent, rarely short-pilose; rachis 0.5–1.0 as long as petiole, sometimes arched upward. Gland 1, usually scutellate, 0.2–0.4 mm broad, sessile or subsessile, rarely short-stipitate, sometimes depressed and obscure. Leaflets bijugate, the superior pair usually longer, joined to rachis by a minute, arcuate, black or brown pulvinule, lanceolate- or oblanceolate-oblong, slightly oblique, straight or the superior blades divergent, glabrous, membranaceous or papyriferous, 0.4–1.4 cm long, 2.1–3.1 mm broad, often gray-green; apex obtuse or rounded. Flowers usually solitary; pedicels straight, somewhat flattened, glabrous or less commonly puberulent in a line, 1.5–2.8 cm long and ca. 0.3 mm thick in flower, up to 3.7 cm long and 0.5 mm thick in fruit; bracts 2, lanceolate or narrowly ovate, 1.5–1.9 mm long, 0.5–0.9 mm broad; bracteoles subopposite or remote, lanceolate, 1.7–2.3 mm long, 0.6–1.1 mm broad; sepals lanceolate, 7.8–11.0 mm long, 2.1–2.6 mm broad; petals 8.9–13.5 mm long, 7.0–10.7 mm broad; ovary marginally or wholly short gray-pilose. Pod narrowly oblong, 1.8–3.1 cm long, 0.4–0.6 cm broad, flat or nearly so, glabrous or sparsely puberulent on sutures. Seeds 8–14, slightly compressed, 3.2–4.7 mm long, 0.7–1.2 mm broad.

Chromsome number: not determined.

Distribution: Brazil, São Paulo and Paraná. Occurring mainly in savannas on sandy soils, from 900 to 2000 feet elevation.

This taxon differs from the typical variety not only in its distinctive habit but also in its slender, wiry stems, the generally smaller foliar organs, and the often glabrous pedicels and fruit. Material from Paraná tends to resemble that of the typical variety, while in São Paulo var. *tenuicaulis* is quite distinct.

As has been discussed under *C. langsdorffii* Kunth var. *langsdorffii,* Bentham treated *Burchell 4280,* very similar to the cited type for the present variety, as a form of *C. langsdorffii.* While it is probable that *C. chartacea* is closely related to *C. langsdorffii,* a critical study of the material of the present taxon reveals that its characters show closer affinity to those of the typical variety of *C. chartacea* than to those of any taxon in the *C. langsdorffii* complex.

BRAZIL, PARANA: Villa Velha, May 1952, *A. A. de Araujo 174* (SI); Passo, 18 Mar. 1904, *P. Dusén s.n.* (S); Ponta Grossa, 15 Dec. 1903, *P. Dusén s.n.* (S) Ponta Grossa, 15 Dec. 1903, *P. Dusén 2709* (S); Tamandua, 1 Feb. 1909, *P. Dusén 7711* (MO, S, US); Jaguariahyva, 15 Jan. 1915, *P. Dusén 16409* (MO); Jaguariahyva, 1 Feb. 1915, *P. Dusén 16602* (S). SAO PAULO: Itirapina, Campo Alegre, 21 Jan. 1951, *G. A. Black 51-11149* (NY); Campos de Itirapina, 23 Jan. 1951, *G. A. Black 51-11280* (UC) ; Itirapina, 1 Feb. 1951, *G. A. Black 51–11744* (NY) ; Sande, 11 Feb. 1912, *A. C. Brade 5626* (S) ; w/o locality, w/o date, *W. J. Burchell 4280* (K) ; w/o locality, w/o date, *W. J. Burchell 5472* (K) ; Parque Jabaquara, 24 Jan. 1924, *F. C. Hoehne* & *A. Gehrt 13231* (GH) ; Itapetininga, Apr. 1947, *J. I. de Limo 60703* (MO) ; w/o locality, 1905, *A. Usteri 62* (K) ; Villa Marianna, 23 Mar. 1907, *A. Usteri 85b* (K) ; w/o locality, 1861–1862, *J. Weir 206* (K).

11. **Cassia malacophylla** Vogel, Syn. Cass., p. 55. 1837. Holotype examined (K): "Brasilia." *Sellow s.n.* w/o date (probably 1814–1815). Isotype (F); photograph of holotype (F, GH, NY).

Creeping, stem-rooting, freely branched subshrub forming extensive matted colonies, the ascending pubescent stems reaching 0.3–0.5 m. Stipules cordate-ovate, acute or acuminate, 0.5–1.4 cm long, 3.1–7.0 mm broad, pubescent, glaucous. Petiole slender, 3.0–5.5 mm long, pubescent; rachis 0.5–0.8 as long as petiole. Gland 1, scutellate, 0.2–0.5 mm broad, sessile or subsessile, often depressed and obscure. Leaflets bijugate, the pairs subequal or the superior pair slightly longer, joined to rachis by a small arcuate or semi-orbicular pulvinule, obovate or oblanceolate, somewhat oblique, loosely pubescent, glaucous, membranous or papyriferous, 0.6–1.8 cm long, 3.5–8.5 mm broad, gray-green, margins ciliate with straight hairs 1.0–1.3 mm long, apex rounded or obtuse. Flowers solitary; pedicels straight or arching upward, pubescent, 2.2–3.4 cm long and ca. 0.4 mm thick in flower, up to 4.8 cm long and 0.7 mm thick in fruit; bracts 2, ovate, 0.3–0.5 mm long, 0.2–0.4 mm broad; bracteoles subopposite or remote, broadly lanceolate or ovate, 2.9–5.1 mm long, 1.3–2.7 mm broad; sepals lanceolate, glabrous within, pubescent without, 7.1–10.5 mm long, 2.8–3.4 mm broad; petals 1.0–1.6 cm long, 0.8–1.4 cm broad; ovary yellow- or gray-pilose. Pod narrowly oblong, 2.5–3.1 cm long, 0.5–0.7 cm broad, faces flat or slightly sulcate between the seeds, pilose, often glaucous. Seeds 9–14, slightly compressed, 4.0–4.3 mm long, 1.5–1.8 mm broad.

Chromosome number: $n = 7$.

Distribution: Brazil, central Minas Gerais, in the southern portion of Serra do Espinhaço, from Serra do Cipó to the vicinity of Diamantina. Very local, occurring on sandy soils in mountain fields and low open woods from 2000–3000 feet elevation.

This well marked species, distinct in habit and copious gray pubescence, shows considerable affinity to *C. chartacea* Irwin in the slender petioles, small gland, thin leaflets, broad petioles, and flat pod. In the vicinity of Diamantina and Guinda the stipules are larger and the leaflets rather narrower and less glaucescent, tending to approach those of *C. tecta* Vog. These tendencies have also been noted by Bentham in Flora Brasiliensis. However, his reference to São Paulo as lying within the range of *C. malacophylla* is subject to question. While *Lund s.n.* (ad São Carlos, prov. S. Paulo) has not been seen, *Hoehne 1816* (SP) (São Paulo, Butatán) has and is in fact merely an unusually puberulent form of *C. chartacea* var. *chartacea*.

BRAZIL, MINAS GERAIS: Serra do Cipó, 8 Dec. 1949, *A. P. Duarte 2238* (MO); Diamantina, 11 Apr. 1892, *A. Glaziou 19096* (NY); Serra do Cipó, 12 Jan. 1959, *H. S. Irwin 2435* (MICH, NY, R, TEX, UC, US, VIC); Serra do Cipó, 5 Sept. 1952, *A. Macedo 3777* (MO, S, SI, US); Serra do Cipó, Palácio, 3 Dec. 1933, *Mello Barreto 5960* (F); In campis altai pr. Paraúna et Tijuca, Dec. 1824, *Riedel 1147* (US).

12. **Cassia tecta** Vogel, Syn. Cass., p. 56. 1837. Photograph of holotype examined (GH, NY): "Brasilia." *Sellow s.n.* w/o date (probably ca. 1829).

Shrub or subshrub to 1.5 m, simple below and few- to many-branched above, or several-branched from the base. Branches rather thick, yellowish-, brownish-, or grayish-pubescent. Stipules large, foliaceous, obscuring the upper stem, cordate-lanceolate to -ovate, acuminate, 1.0–1.9 cm long, 0.4–1.0 cm broad, yellow-pubescent.

Petiole 0.3–0.7 cm long, the adaxial groove pubescent, the abaxial surface pubescent and pilose; rachis 0.4–0.7 as long as petiole. Gland 1, scutellate, rarely urceolate, 0.4–0.6 mm broad, sessile or subsessile. Leaflets bijugate, the pairs equal or the inferior pair slightly longer, sessile by a small, black, arcuate pulvinule 1.0–1.6 mm long, oblanceolate to narrowly obovate, straight, finely yellow-pubescent, firmly membranaceous, 1.0–1.9 cm long, 0.5–0.7 cm broad, often olive-green; margins ciliate. Flowers solitary; pedicels straight, yellow-pubescent, 1.5–2.0 cm long and ca. 0.4 mm thick in flower, up to 2.4 cm long and 0.8 mm thick in fruit; bracts 2, broadly lanceolate or ovate, 2.2–2.6 mm long, 1.8–2.1 mm broad; bracteoles subopposite, lanceolate, 3.1–4.6 mm long, 1.4–1.8 mm broad; sepals lanceolate, 1.1–1.5 cm long, 4.5–5.5 mm broad; petals 1.2–1.7 cm long, 0.8–1.3 cm broad; stamens yellow or yellow-brown; ovary densely yellow-pilose. Pod narrowly oblong, 3.2–4.1 cm long, 5.7–7.0 mm broad, nearly flat, yellow-pilose. Seeds 8–13, black, slightly compressed, 4.1–5.6 mm long, 1.6–2.1 mm broad.

Chromosome number: $n = 7$.

Distribution: Brazil, central Minas Gerais and central São Paulo. Occurring in mountain fields and low open woods on sandy soils from 2000–3500 feet elevation.

Cassia tecta is another of the several taxa in the section *Xerocalyx* which occur in the southern Serra do Espinhaço from Serra do Cipó to the vicinity of Diamantina. In this case, however, the range extends further southward to include the relatively treeless outcrops in the forested hills near Itabira and Sabará (*Weddell 216*). In São Paulo *C. tecta* is apparently limited to mountain slopes in various localities. Present records indicate a disjunction of about 300 miles between Minas Gerais and São Paulo populations. However, it is probable that in the intervening Serra da Canastra of southwestern Minas Gerais, which has a considerable area in the elevational range of this species, *C. tecta* will be found.

Presently known material, from both Minas Gerais and São Paulo, when considered together, is remarkably homogeneous (*Duarte 2650,* from Serra do Cipó, with broad stipules and leaflets, the only outstanding exception seen) . On the basis of the firm leaflets, large stipules, and rather thick pedicels, *C. tecta* shows affinity to *C. langsdorffii* Kunth. This impression is intensified by the apparent intergradation between this species and *C. langsdorffii* var. *parvifoliola* Irwin in Serra do Cipó, previously mentioned in connection with the latter taxon. However, in most instances observed by the present author in that area, *C. langsdorffii* var. *parvifoliola* was far commoner than *C. tecta;* it was not surprising then that the majority of intermediates appeared as somewhat pubescent, larger stipulate forms of *C. langsdorffii* var. *parvifoliola* (e.g. *Irwin 2429a*) .

BRAZIL, GOIAS: Chapadão dos Veadeiros, w/o date, *A. Glaziou 20990* in part (S, UC). MINAS GERAIS: w/o locality, Aug.–Apr. 1840, *P. Claussen s.n.* (BM) ; Serra do Cipó, k. 131, 24 Apr. 1950, *A. P. Duarte 2650* (MO, NY) Diamantina, au Curalinho, 7 Mar. 1892, *A. Glaziou 19095* (P) ; Serra do Cipó, 12 Jan. 1959, *H. S. Irwin 2425* (MICH, NY, R, TEX, UC, US, VIC); Serra do Cipó, 12 Jan. 1959, *H. S. Irwin 2430* (MICH, NY, R, TEX, UC, US, VIC); w/o locality, 1844, *Weddell 216?* (K, P). SAO PAULO: Ypiranga, 18 Feb. 1912, *A. C. Brade 5630* (S); w/o locality, 1833, *Gaudichaud s.n.* (Herbier Imperial de Brésil) 893 (P); Prainha (?), 1839, *Guillemin 422* (K); Parque do Estado, S. Paulo, 2 Feb. 1934, *Hoehne 31569* (NY); Encentro Repreza e Villa Mariana (?), 29 Apr. 1905, *A. Usteri 60* (K).

13. Cassia saxatilis (Amsh.) Irwin, comb. nov.
Holotype examined (U): Surinam, "Knopoimoi, top." *H. E. Rombouts 809*. Aug. 1937.

Cassia tetraphylla Desv. var. *saxatilis* Amsh., On S. Am. Papilionaceae, p. 27. 1939.

Herb or subshrub, ascending or decumbent, often, much branched from near the base, the glabrous or puberulent branches horizontal or ascending, to 75 cm. Stipules cordate- or auriculate-lanceolate, acuminate or sub-piliferous, 5.0–9.5 mm long, 1.6–3.5 mm broad, glabrous, usually ciliolate. Petiole 2.0–6.5 mm long, puberulent; rachis 0.2–0.4 as long as petiole. Gland 1, scutellate, 0.2–0.7 mm broad, subsessile or elevated on a slender stipe 0.1–0.6 mm long. Leaflets bijugate, the inferior pair longer, joined to rachis by a small semi-orbicular dark brown or black pulvinule 0.2–0.9 mm broad, oblanceolate to obovate, the superior blades slightly and the inferior blades more strongly falcate, glabrous or occasionally puberulent beneath, firmly membranaceous, 0.8–1.5 cm long, 3.5–7.2 mm broad; margins sometimes ciliolate, apically mucronate, obtuse, or rounded. Flowers solitary or in pairs, pedicels straight, unilaterally or wholly puberulent, 1.4–2.7 cm long and ca. 0.3 mm thick in flower, up to 3.8 cm long and 0.5 mm thick in fruit; bracts 2, lanceolate or narrowly ovate, 1.2–1.6 mm long, 0.6–0.9 mm broad; bracteoles subopposite, narrowly lanceolate, 1.8–2.6 mm long, 0.4–0.7 mm broad; sepals lanceolate, 5.1–8.7 mm long, 1.4–2.3 mm broad; petals 0.6–0.7 mm long, 0.4–0.7 mm broad; ovary finely gray-pilose. Pod narrowly oblong, often falcate, 1.6–2.8 cm long, 4.5–5.7 mm broad, flat or somewhat sulcate between the seeds, sparingly puberulent or short-pilose. Seeds 3–8, flattened, 2.7–3.2 mm long, 1.3–2.0 mm broad.

Chromosome number: not determined.

Distribution: Central and southern Surinam, eastward in French Guiana to Amapá, Brazil. Occurring in granite mountains among low vegetation, between 1500 and 3000 feet elevation, and at lower altitudes along creeks in exposed rocky positions.

The material available in this taxon shows a narrow range of variability, and the total characters displayed suggest relationship to *C. gracilis* Kunth rather than to *C. tetraphylla* Desv. The leaflet form, slender pedicels, diminutive flowers, and small, few-seeded pods are very similar to those of the former species, while there is nothing, save the subsessile gland of some specimens, which would indicate the close relationship to *C. tetraphylla* that Amshoff's proposal implies. Specific rank is felt to be in order here not only because of the geographical separation of this taxon from *C. gracilis* but also because of such distinctive characters as the lax habit, persistent stipules, larger leaflets, puberulent petioles, and broad seeds. Seeds in *C. saxatilis* are the broadest of any in the section *Xerocalyx,* but show the lines of fine pitting characteristic of the section.

BRAZIL, AMAPA: Campo Inocência, Oiapoque, 4 Oct. 1941, *G. A. Black 49–8373* (NY); w/o locality, 27 June 1904, *A. Ducke 4800* (MG); Cachoeira Grande Roche, Oiapoque, 29 Apr. 1960, *W. A. Egler 1461;* Roche Mon Pere, Rio Oiapoque, 17 Aug. 1960, *W. A. Egler 47647;* Cachoeira Grande Roche, Rio Oiapoque, 27 July 1960, *H. S. Irwin, W. A. Egler, & J. M. Pires 47136;* Roche Mon Pere, Rio Oiapoque, 4 Oct. 1960, *H. S. Irwin, J. M. Pires, & L. Y. Th. Westra 48644;* Campo near Santo Antônio, Rio Oiapoque, 23 July 1960, *B. Maguire, J. M. Pires, & C. K. Maguire 47122;* Cachoeira Cacherí, Rio Oiapoque, 14 Aug. 1960, *J M. Pires 47533;* Mt. Carupina, Rio Uaçá, 14 Oct. 1960, *J. M. Pires & L. Y. Th.*

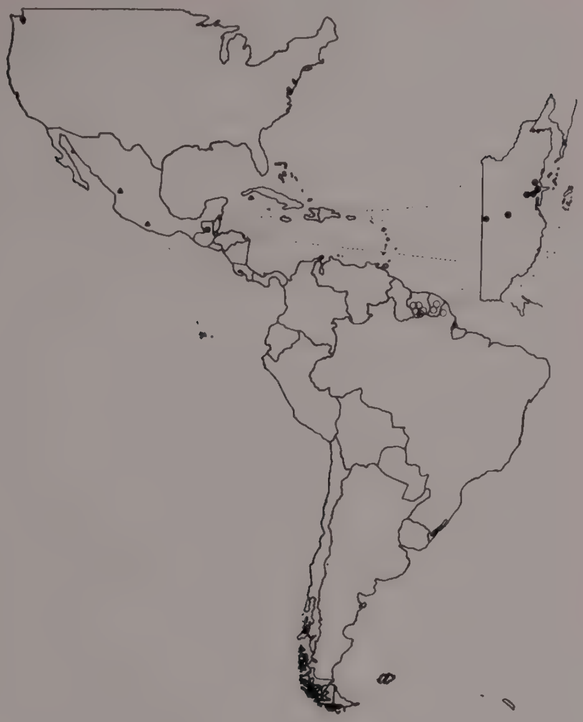

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FIG. 348. Map showing distribution of *C. saxatilis* (open circles), *C. bartlettii* (closed circles), and *C. madrensis* (closed triangles).

Westra 48836; near Porto Platón, Rio Araguarí, 16 Sept. 1961, *J. M. Pires, W. Rodrigues, & G. C. Irvine 50970.*

FRENCH GUIANA: Cayenne, 1835, *M. Leprieur s.n.* (K).

GUIANA: w/o locality, 1840, *H. F. Talbot s.n.* (K).

SURINAM: Granitic plateau in line from Paka paka (Saramacca R.), to Ebbatop (v. Asch v. Wijcks–Range), 10 Feb 1951, *J. Florschütz & P. A. Florschütz 1272* (NY, U); Stone block, Voltzberg (foot), 18 Sept. 1933, *J. Lanjouw 871* (U); Voltzberg, 7 Feb. 1920, *A. Pulle 267* (NY, U); Fluv. Tapanahoni sup. prope Mount Teeboe, Aug. 1904, *Versteeg 775* (U).

LOCALITY UNKNOWN: w/o locality, w/o date, *Herb. Rudge s.n.* (BM).

14. **Cassia bartlettii** Standley, Field Mus. Nat. Hist. Publ., Bot. Ser. 9: 132–133. 1932. Holotype examined (MICH): British Honduras, "Mountain Pine Ridge." *H. H. Bartlett 11649.* 12 Feb. 1931.

Erect shrub or subshrub to 1.5 m, with few to several strongly ascending patently pilose branches. Stipules wholly or partly obscuring the upper stem, cordate-lanceolate to narrowly cordate-ovate, acute or obtuse and mucronate, 0.7–1.4 cm long, 2.2–4.7 mm broad, glabrous, often ciliolate. Petiole 3.0–5.5 mm long, the adaxial groove pubescent, the abaxial surface pubescent and often pilose with distally-directed hairs; rachis 0.3–0.5 as long as the petiole. Gland 1, scutellate or shallowly urceolate, 0.3–0.7 mm broad, sessile or subsessile. Leaflets bijugate, the inferior pair often larger, joined to rachis by a small, arcuate or semi-orbicular, brown or black pulvinule 0.6–1.1 mm long, oblancolate to oblong-obovate, oblique or somewhat falcate, glabrous, firmly membranaceous, 1.4–2.2 cm long, 4.2–7.0 mm broad; margins often ciliolate, the apex obtuse or rounded. Flowers solitary or in pairs; pedicels straight, yellow-pubescent or -pilose, 1.5–2.7 cm long and ca. 0.4 mm thick in flower, up to 3.1 cm long and 0.8 mm thick in fruit; bracts 2, ovate, 2.0–2.6 mm long, 1.3–1.7 mm broad; bracteoles subopposite, broadly lanceolate, 3.8–4.9 mm long, 2.0–2.7 mm broad; sepals lanceolate, glabrous, 0.8–1.6 cm long, 2.7–4.0 mm broad; petals 1.4–1.7 cm long, 1.1–1.3 cm broad; ovary yellow- or gray-pilose. Pod narrowly oblong, 3.3–4.2 cm long, 6.5–7.6 mm broad, faces usually somewhat sulcate between the seeds, yellow-hispid, the sutures densely so. Seeds 11–15, slightly flattened, 3.7–5.0 mm long, 1.9–2.4 mm broad.

Chromosome number: not determined.

Distribution: British Honduras, and possibly adjacent Guatemala. Occurring in open woods, often on sandy ridges, from sea level to 1000 feet elevation.

C. bartlettii most closely resembles *C. tetraphylla* Desv. var. *colombiana* Irwin of the high drainage of the Amazon in central and eastern Colombia. *C. tetraphylla* var. *aurivilla* Irwin, to which *C. bartlettii* has propinquity, is distinct from the latter in most respects save the fulvous pubescence of ovary and fruit.

The distribution of this species west of British Honduras is at this time entirely speculative, but may be regarded as likely. The type itself is from the El Cayo district, near the western border of British Honduras. The Mociño and Sessé collection was probably made between June and December of 1796, during which time Mociño and his party were presumably in the mountains between Chiapa de Corzo, Mexico, and Guatemala City (Rickett, 1947). While their route in this area is evidently not known, they could have deviated eastward and descended the slopes at least to a level that would have brought them in contact with the lowland vegetation of northeastern Guatemala and adjacent British Honduras. This area, like much of the Yucatán Peninsula, is still little explored.

BRITISH HONDURAS: Pine Ridge, Cornhouse Creek, 31 Jan. 1931, *H. H. Bartlett 11306* (MICH); Near Manatee, Belize District, 5 Oct. 1940, *P. H. Gentle 3408* (GH, MICH); w/o locality, w/o date, *J. B. Kinlock 76* (BM); 3 miles west of Boomtown, 23 Aug. 1936, *H. O'Neill 8602* (GH, MICH); Pine Ridge near Manatee Lagoon, 25 July 1905, *M. E. Peck 78* (GH, K); All Pines, 21 July 1930, *W. A. Schipp 557* (BM, GH, K, MICH, S, UC).

GUATAMALA?: w/o locality (Plantae Novae Hispaniae), 1787–1795–1804 (probably 1796), *Sessé, Mociño, Castillo, & Moldonado 1173* (BM, F).

15. **Cassia madrensis** (Rose) Irwin, comb. nov.

Holotype examined (US): Mexico, Nayarit, "between Aguacata and Dolores, Tepic.) Isotype (NY). *J. N. Rose 2023.* 6 Aug. 1897.

Chamaecrista madrensis Rose, in Fl. N. Am. 23 (5): 274. 1930.

Subshrub or low shrub to 1 m (?), the puberulent branches often numerous and short. Stipules lanceolate-cordate, acute or acuminate, 0.7–1.0 (–1.6) cm long, 2.5–3.4 (–4.5) mm broad, glabrous, ciliolate. Petiole 2.8–3.4 mm long, puberulent; rachis 0.2–0.3 as long as petiole. Gland 1, scutellate, 0.3–0.6 mm broad, sessile or depressed and obscure. Leaflets bijugate, the pairs equal or the inferior somewhat broader, joined to rachis by a small arcuate or semi-orbicular dark brown or black pulvinule 0.2–0.4 mm long, oblanceolate or oblanceolate-oblong, oblique, glabrous, firmly membranaceous, 1.2–1.9 cm long, 3.5–5.1 mm broad; margins distally ciliolate, the apex obtuse or rounded. Flowers solitary or in pairs; pedicels straight or arching upward, yellow-puberulent or -pubescent, 1.3–2.3 cm long and ca. 0.4 mm thick in flower, up to 2.8 cm long and 0.7 mm thick in fruit; bracts 1 or 2, ovate or broadly ovate, 1.8–2.2 mm long, 1.2–1.5 mm broad; bracteoles subopposite, divergent, ovate, 3.1–3.6 mm long, 1.8–2.4 mm broad; sepals lanceolate of narrowly ovate, 4.8–10.1 mm long, 2.5–3.5 mm broad; petals 1.2–1.7 cm long, 0.8–1.4 cm broad; ovary finely yellow-pubescent. Pod narrowly oblong, 3.1–3.9 cm long, 4.2–6.5 mm broad, faces flat or slightly sulcate between the seeds, sparsely yellow-pubescent. Seeds 10–15, slightly flattened, 3.2–4.8 mm long, 1.3–1.6 mm broad.

Chromosome number: not determined.

Distribution: Mexico, known only from the type locality and in Guerrero. Occurring (in Guerrero) in open pine and oak forest at ca. 1000 feet elevation.

This species, distinct from *C. bartlettii* Standl. by its lower stature, diminutive structure, and less copious pubescence, most closely resembles the Colombian *Chamaecrista lehmannii* Britt. & Rose which is but a long-pedicellate variant of *C. tetraphylla* Desv. var. *brevipes* (Benth.) Irwin. The type specimen is deficient in a number of structures, especially flowers and young pedicels; the more adequate Hinton material agrees in such points as can be compared, save the larger stipules whose maximum dimensions are parenthetically indicated in the description.

MEXICO, GUERRERO: La Soledad, Distr. Galeana, 5 Jan. 1938, *G. B. Hinton et al. 11192* (BM, GH, MICH, NY, U, UC).

16a. Cassia tetraphylla Desvaux, Journ. Bot. III: 72. 1814. var. **tetraphylla.** Neotype (GH): Brazil, Para, "Altar do Chão." *J. W. H. Traill 175.* 4 Jan. 1874. Isotypes (K, P).

Chamaecrista tetraphylla (Desv.) Britt. & Rose, Ann. N.Y. Acad. Sci. 35: 183. 1936.
Cassia desvauxii Collad., Hist. Cass., p. 131. 1816.
Chamaecrista desvauxii (Collad.) Britt., Brittonia 3: 165. 1939.
Cassia tetraphylla Desv. var. *longifolia* Amsh., On S. Am. Papilionaceae. p. 26. 1939. Photograph of holotype examined (U): "Para."
Cassia pulchra H. B. K., Nov. Gen. & Sp. VI: 362. 1823. Holotype (P) not examined.
Chamaecrista pulchra (H. B. K.) Britt & Rose, Ann. N.Y. Acad. Sci. 35: 184. 1936.

Shrub or subshrub to 1.5 m tall, with numerous erect or ascending pubescent or rarely glabrate branches. Stipules lanceolate- to ovate-cordate or deltoid, acute or acuminate (rarely rounded), 0.5–1.0 (–1.5 in central Brazil) cm long, 2.0–5.5 mm broad, glabrous or rarely puberulent or pubescent. Petiole 2.8–6.2 mm long, the adaxial groove finely pubescent or rarely glabrous, the abaxial surface pubescent and pilose with distally-directed hairs, rarely glabrous; rachis 0.4–0.7 as long as petiole. Gland 1, scutellate or rarely shallowly urceolate, 0.5–1.2 mm broad, sessile or subsessile. Leaflets bijugate, the superior pair longer or (in central Brazil) the pairs of equal length and the inferior pair broader, joined to rachis by a small arcuate usually black pulvinule 0.6–1.7 mm long, oblanceolate to obovate, straight or somewhat falcate, the inferior leaflets rarely strongly so, glabrous or rarely puberulent or pubescent, sometimes glaucous, firmly membranaceous or subcoriaceous, 1.4–3.2 cm long, 0.5–1.1 cm broad; margins occasionally distally ciliate, the apex rounded or obtuse and often mucronate, rarely erose-crenulate. Flowers solitary or in pairs, puberulent or pubescent, rarely glabrous, 1.5–3.8 cm long and ca. 0.4 mm thick in flower, up to 5.0 cm long and 0.8 mm thick in fruit; bracts 2, ovate or lanceolate, 1.5–2.3 mm long, 0.9–1.8 mm broad; bracteoles subopposite or rarely remote, usually appressed, lanceolate, 2.6–3.7 mm long, 1.1–1.6 mm broad; sepals lanceolate, glabrous or rarely exteriorly puberulent, 1.1–1.7 cm long, 3.5–4.2 mm broad; petals 1.7–2.2 cm long, 1.5–1.9 cm broad; ovary grayish- or yellowish-pilose. Pod narrowly oblong, 3.6–4.7 cm long, 5.7–6.8 mm broad, valves mostly flat, sparsely appressed pubescent, rarely appressed-puberulent or -hirsute. Seeds more or less flattened, 3.9–5.0 mm long, 1.2–2.4 (–3.0) mm broad.

Chromosome number: $n = 7$.

Distribution: Venezuela, eastward through the Guianas to Pará, Brazil, southward to Minas Gerais, São Paulo, and Paraná, and in adjacent Paraguay. Occurring in low open woods and savannas, chiefly on sandy soils, from near sea level to 5000 feet elevation.

The nomenclatural confusion associated with this taxon reflects considerable biological diversity. The varietal entities recognized in the present treatment are distinct taxa which, on morphological and geographical grounds, are readily separable from the main mass of the *C. tetraphylla* complex. What remains is by no means homogeneous, but there is as yet insufficient evidence to favor recognition of further infra-specific taxa.

Bentham's acceptance of *C. desvauxii* in preference to the earlier *C. tetraphylla* Desv. was in accordance with the belief of Colladon (1816) and de Candolle (1825) that *C. tetraphylla* Mill. was an earlier homonym. However, as indicated by Burkart (1957), there is no published record of *C. tetraphylla* Mill., and therefore this name must be considered a nomen nudum. For this reason, *C. tetraphylla* Desv. must be accepted as the earliest legitimate name.

Amshoff (1939) indicated, in her circumscription of *C. tetraphylla* in Surinam, that she examined the type specimen (unidentified as to collector) at Paris. However, the present author has been unable to locate this presumed type, nor did Bentham see it in connection with his monograph (1871). Desvaux (1814), in his original diagnosis of *C. tetraphylla,* recognized 2 forms. The first, "A. foliis obovatis obtusis," is taken to be the typical form; the second, "B. foliis lanceolatis acutis," is probably a form of *C. tetraphylla* var. *brevipes* (Benth.) Irwin with particularly long fructal pubescence: "Elle differe de la *Cassia lanceolata* pars ses fruits velus, et par son port." These same variants were recognized by Colladon (1816). The material examined by Amshoff must, when her characterization of it is compared with the material at hand, have been singularly diminutive or depauperate in foliolar dimension, to wit: "Leaflets . . . (up to) 1 cm long," and, in consequence, "pedicels during flowering 1–2 times as long as the leaves." No material examined in the course of the present study had leaflets shorter than the figure Amshoff gives as a maximum, nor were any pedicels more than 1.2 times longer than the largest leaflets observed.

The *C. tetraphylla* var. *longifolia* of Amshoff (1939) is, as she indicated, quite variable, especially in stipule form, and because this variant is in fact characterized by a degree of foliolar length which appears almost thoughout the range of *C. tetraphylla,* the recognition accorded the Surinam material seems unsound.

C. pulchra H. B. K., differing from *C. tetraphylla* by rounded leaflet apices, a character which, while fairly uniform in most material from Colombia, Venezuela,

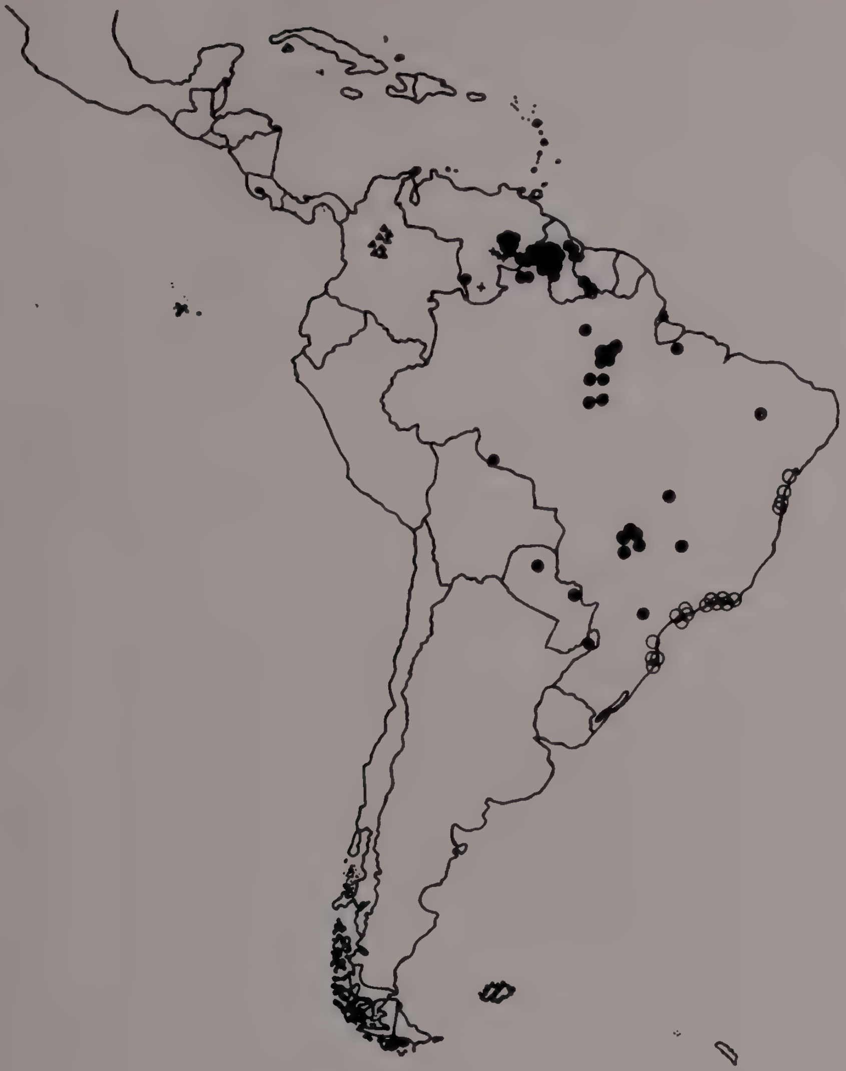

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FIG. 349. Map showing distribution of *C. tetraphylla* var. *tetraphylla* (closed circles), *C. tetraphylla* var. *colombiana* (closed triangles), *C. tetraphylla* var. *littoralis* (open circles), and *C. tetraphylla* var. *ventuarensis* (crosses).

and the Guianas, is nonetheless common throughout the range of *C. tetraphylla,* similarly should not be segregated.

From close examination of exsiccatae available, the following forms, best left unnamed but perhaps of potential varietal status, should be noted:

(1) From stream banks in the vicinity of Mt. Auyan-tepuí, Edo. Bolívar, Venezuela, there have come 2 collections (*K. D. Phelps* & *C. B. Hitchcock 307* in part; *Vareschi* & *Foldats 4544*) in which all parts except glands, corolla and the

inner calycular surfaces are velvety-pubescent. In this respect, *C. tetraphylla* var. *mollissima* (Benth.) Irwin of South Brazil is suggested, but the Venezuelan variant, as far as it is known, has shorter stipules; leaflets narrower, both pubescent and glaucous beneath, gray-green (not yellow-green) above; bracteoles more nearly approximate; pod with longer but more sparingly distributed pubescence. *Maguire & Maguire 35386* and *35471* from Serrania Yutaje in Edo. Amazonas, Venezuela, is similar except that in age the leaflets become glabrate.

(2) From the lower slopes of Mt. Roraima and in the high savannas to the south and west there is a form, most frequently seen along water courses, in which the petiole is glabrous and the inferior leaflets are strongly inflexed, the superior pair remaining quite or nearly straight. One specimen, *Altson 538* (NY), bore an unpublished specific annotation. This variant approaches the Surinam and Pará material designated *C. tetraphylla* var. *longifolia* by Amshoff, the latter differing by its oblong stipules and pubescent petioles, while in the Gran Sabana, to the west of Roraima, there is intergradation with the typical var. *tetraphylla*. *Maguire & Maguire 40046,* from Serra Tepequém, southwest of Roraima in the Brazilian territory of Rio Brânco, is similar to this form, but *Maguire & Maguire 40043,* from the same locality, is clearly referable to var. *tetraphylla*.

(3) In the mountains of central Minas Gerais and southern Goiás, where extensive variability has been noted in connection with other taxa, *C. tetraphylla* approaches *C. langsdorffii,* assuming characters suggestive of *C. langsdorffii* Kunth var. *latifoliola* Irwin of Paraguay. The lanceolate or narrowly ovate stipules are largely in the 1.0–1.5 cm range in length; petiolar glands are frequently slightly elevated and ovoid; the inferior pair of leaflets is commonly broader and occasionally longer than the superior pair; and flowers tend to be smaller. Pronounced glaucescence occurs in the vicinity of Diamantina (e.g. *Irwin 2469*). One population in southern Goiás (*Irwin 2556a*) is indeed remarkable, having, in addition to stipules ca. 2.0 cm long and 0.7 cm broad, and other characters of this form, a brilliant scarlet banner petal. This last condition, in less striking degree, was noted in *C. chartacea* Irwin var. *chartacea* (*Irwin 2420*).

(4) The majority of material from Paraná and Paraguay which has been examined shows stem pubescence, stipule size, and leaflet form similar to the expression of these characters in *C. tetraphylla* var. *mollissima* (Benth.) Irwin. It would appear that in this area, the southern distributional limit of both var. *tetraphylla* and var. *mollissima,* considerable intergradation occurs between these taxa.

It is clear that in *C. tetraphylla* var. *tetraphylla* morphological variability differs from population to population, and is so varied that further designation of infraspecific taxa should not be attempted until this variable complex becomes better known over its entire geographical range. However, the varietal taxa which have been proposed seem distinct within their respective regions.

ARGENTINA, MISIONES: Loreto, Mar. 1932, *J. Vallega s.n.* (SI).

BRAZIL, CEARA: Serra de Aripe between Crato and Brejo Grande, Feb. 1839, *Gardner 2412* (K). GOIAS: Region of Chapada dos Veadeiros, 7 km S of Veadeiros, 24 Apr. 1956, *E. Y. Dawson 14613* (NY); 118 km NW of Itumbiara on road to Rio Verde, 2 Feb. 1959, *H. S. Irwin 2553* (MICH, NY, R, TEX, UC, US, VIC); 16 km W of Rio Verde on road to Caiaponha, 3 Feb. 1959, *H. S. Irwin 2556* (MICH, NY, R, TEX, UC, US, VIC); 16 km W of Rio Verde on road to Caiaponha, 3 Feb. 1959, *H. S. Irwin 2556a* (MICH, NY, R, TEX, UC, US, VIC). MINAS GERAIS: 51 km W of Uberlândia on road to Tupaciguara, 1 Feb. 1959, *H. S. Irwin 2535* (MICH, NY, R, TEX, UC, US, VIC); Campina Verde, 23 Jan. 1944, *A. Macedo 222* (S); Felisberto Caldeira, Diamantina, 27 Nov. 1937, *Mello Barreto 10048* (F). PARA: Santarém, campo maricageux, 11 Aug. 1902, *A. Ducke 2926* (BM in part, MG); Prainha, 10 Apr. 1903, *A. Ducke 3597* (MG); Lago de Altar do Chão, 11 Mar. 1901, *A. Ducke 10244* (BM in part, MG); Alto Ariramba, 9 Dec. 1910, *A. Ducke 11359* (MG); Baixo Jamundá, Lago das 2 bocas, 18 May 1911, *A. Ducke 11785* (MG); Rio Mojú, Campo Piranema, Nov. 1913. *A. Ducke 15074* (MG); E. F. de Acobaça, campo de Arumatina, 4 Jan. 1915, *A. Ducke 15630* (MG); Alto Tapajós, Rio Cururú, Missão Velha, 21 July 1959, *W. A. Egler 992* (MG); Aramanahy, in ripis fl. Tapajóz inferioris, 1 Apr. 1924, *J. G. Kuhlmann 17808* (S, U); Santarém, 24 Mar. 1924, *J. G. Kuhlmann 17809* (U); Aramanahy, Tapajóz R., Oct. 1931, *R. Monteiro da Costa 128* (F); Tapajóz, Aramanahy, 5 Feb. 1932, *R. C. Monteiro da Costa 310* (F, US); Belterra, Pindobal (?), 23 Dec. 1956, *J. M. Pires, G. A. Black, J. J. Wurdack, & N. T. Silva 6508* (NY); In vicinibus Santarém, Nov–Mar. 1849–1850, *Spruce s.n.* (BM, P). PARANA: Jaguariahyva, 5 Feb. 1910, *P. Dusén 9198* in part (GH, MO, S). RIO BRANCO: Serra Tepequém, 25 Nov. 1954, *B. Maguire* and *C. K. Maguire 40043* (NY, US); Serra Tepequém, 25 Nov. 1954, *B. Maguire* and *C. K. Maguire 40046* (F, NY); Kotinga Valley, autumn 1894, *J. J. Quelch & F. McConnell 151* (K). RONDONIA: Rio Guaporé, Fazenda Santa Rosa, 11 June 1952, *G. A. Black & E. Cordeiro 52–14860* (UC).

BRITISH GUIANA: Near Koricabaru Valley, Ireng District, May 1926, *R. A. Altson 538* (K, P); Upper Mazaruni River, 22 Sept–6 Oct. 1922, *J. S. De La Cruz 2103* (F, MO, NY, UC, US); Upper Mazaruni River, 22 Sept–6 Oct. 1922, *J. S. De La Cruz 2211* (F, GH, NY, UC, US); 5 mi. E. of Atkinson Field, 28 Mar. 1953, *H. S. Irwin 34* (TEX, US); 3 miles E of Atkinson Field, 29 Jan. 1955, *H. S. Irwin 656* (TEX); Orinduik Falls, Ireng River, 10 Oct. 1955, *H. S. Irwin 765* (TEX); Mt. Ayanganna, Pakaraima Mts., 1 Feb. 1955, *B. Maguire, W. M. C. Bagshawe,* and *C. K. Maguire 40558* (NY); Imbaimadai Savannahs, Upper Mazaruni River, 18 Nov. 1951, *B. Maguire & D. B. Fanshawe 3248* (NY) Roraima, 1842–1843, *Rich. Schomburgk 839* (BM)=*Robt. Schomburgk 528* (BM, K, NY).

PARAGUAY: Paraguaria septentrionalis in regione cursus superioris fluminis Apa, 1901–2, *E. Hassler 8007* (BM, F, GH, NY, P, S, UC); In altaplanitie et declivibus Sierra de Amambay, 1907–8, *E. Hassler 10344* (BM, F, GH, NY, S, UC).

SURINAM: Boven Sipaliwini R., Kamp IV, 24 Oct. 1935, *H. E. Rombouts 239* (U); Boven Sipaliwini, Kamp VII, 12 Nov. 1935, *H. E. Rombouts 260* (U).

VENEZUELA: Mount Auyantepuí, Sept. 1937, *F. Cárdona 86* (US); Río Tonoro, Alto Río Paragua, 20 Aug. 1943, *F. Cárdona 837* (NY, US); Angel Falls, 5 Apr. 1950, *R. Kunhardt, Jr. 14* (NY); Below Cerro Yavita, Río Temi, Río Atabapo, Río Orinoco, 20 Oct. 1950, *B. Maguire 29332* (NY); Kamarang Head, Ilu-tepuí, Gran Sabana, 6 Mar. 1952, *B. Maguire 33297* (F, NY) Banks of Río Aprada, mouth of Caño Ambutuil, 24 Jan. 1948, *G. G. Simpson 8* (US); Gran Sabana, between Kun and Uaduara-parú, valley of Río Kukenán, south of Mount Roraima, 1 Oct. 1944, *J. A. Steyermark 59096* (F, MO); Gran Sabana, between mission of Santa Teresita de Kavanayén northwest to Río Karuai, 26 Oct. 1944, *J. A. Steyermark 59386* (MO); Río Karuai, between Santa Teresita de Kavanayén and base of Ptaritepuí, 18 Nov. 1944, *J. A. Steyermark 60323* (F, MO); Chimantá Massif, vicinity of Techiné-Merú, Río Aparurén, between mouth of Río Aparurén and Konquén, 8 July 1953, *J. A. Steyermark 76062* (NY) Chimantá Massif, playa at base of Techinémerú, Río Tirica (Río Aparurén), 17 Jan. 1955, *J. A. Steyermark & J. J. Wurdack 152* (NY); Sta. Elena, Gran Sabana, 11 Feb. 1946, *F. Tamayo 2738* (US); Mount Auyantepuí, Dec. 1937–Jan. 1938, *G. H. H. Tate 1161* (NY); Río Aicha, cerca del Campamento Urullen, Apr. 1956, *Vareschi & Foldats 4544* (NY).

16b. Cassia tetraphylla var. linearis Irwin, var. nov.
Holotype (K): Brazil, Pernambuco, "banks of the Rio Preto." *Gardner 2828.* Sept. 1839. Isotype (NY).

Planta fruticosa aut suffruticosa, subprocumbens (*ex* Gardner), ramis ascendentibus puberulentibus usque ad 1 mm long. Stipulae adpressae persistentes lanceolato-cordatae acuminatae, 4.1–7.5 mm long., 1.0–1.7 mm lat., puberulentes ciliolatae integrae. Petiolus 2.0–2.4 mm long., canaliculo adaxiali puberulente, superficie abaxiali puberulente necnon saepe pilosa, pilis distaliter directis; rachis 0.2–0.5 brevior quam petiolus, terminaliter aristata. Glans 1 scutellata, 0.3–0.5 mm lat., sessilis, saepe depressa ac non perspicua. Foliola bijugata, pari superiore longiore ac saepe divergente, per pulvinulum parvum atrum semiorbicularem c. 0.5 mm lat. sessilia, linearia aut lineari-lanceolata, ad basim obliqua, glabra aut puberulentia, saepe ciliolata, firme membranacea aut subcoriacea, 1.1–2.4 cm long., 1.5–1.9 mm lat.; margines integri, apice acuto. Flores axillares, maxima ex parte singulares; pedicelli puberulentes, 2.0–13.0 mm long., c. 0.3 mm crass. dum florentes, usque ad 1.5 cm long., 0.5 mm crass. dum frugiferentes; bracteae 2 squamoideae minutae; bracteolae oppositae aut quasi oppositae, divergentes lanceolatas aut anguste ovatae, 2.2–4.1 mm long., 1.2–1.5 mm lat.; sepala lanceolata aut anguste ovata, intus glabra, extra puberulentia, 3.5–8.3 mm long., 2.2–3.0 mm lat.; petala flava, 4.0–9.5 mm long, 3.5–8.0 mm lat.; stamina flava; ovarium subcinereo- aut subflavo-pubescens. Siliqua anguste oblonga, 1.8–2.4 cm long., 4.0–4.6 mm lat., valvis planis puberulentibus secundum suturas copiose puberulentibus. Semina 7–10 levia dura atro-brunnea aut atra, complanata, 3.1–4.0 mm long., 1.1–1.4 mm lat.

Subprocumbent (Gardner's label data) shrub or subshrub, the ascending puberulent branches reaching 1 m. Stipules lanceolate-cordate, acuminate, 4.1–7.5 mm long, 1.0–1.7 mm broad, puberulent, ciliolate. Petiole 2.0–2.4 mm long, the adaxial groove puberulent, the abaxial surface puberulent and often pilose with distally-directed hairs; rachis 0.2–0.5 as long as petiole. Gland 1, scutellate, 0.3–0.5 mm broad, sessile, often depressed and obscure. Leaflets bijugate, the superior pair longer and often divergent, joined to rachis by a small semi-orbicular black pulvinule ca. 0.5 mm broad, linear or linear-lanceolate, oblique at base, glabrous or puberulent, often ciliolate, firmly membranaceous or subcoriaceous, 1.1–2.4 cm long, 1.4–1.9 mm broad; apex acute. Flowers mostly solitary; pedicels puberulent, 2.0–13.0 mm long and ca. 0.3 mm thick in flower, up to 1.5 cm long and 0.5 mm thick in fruit; bracts 2, scale-like, minute; bracteoles nearly or quite opposite, divergent, lanceolate or narrowly ovate, 2.2–4.1 mm long, 1.2–1.5 mm broad; sepals lanceolate or narrowly ovate, glabrous within, puberulent without, 3.5–8.3 mm long, 2.2–3.0 mm broad; petals 4.0–9.5 mm long, 3.5–8.0 mm broad; ovary grayish- or yellowish-pubescent. Pod narrowly oblong, 1.8–2.4 cm long, 4.0–4.6 mm broad, valves flat, puberulent, copiously so along the sutures. Seeds 7–10, flattened, 3.1–4.0 mm long, 1.1–1.4 mm broad.

Chromosome number: not determined.

Distribution: Brazil, known only from the type locality in Pernambuco and from Serra Jacobina in Bahia. Habitats not known.

As was discussed under *C. langsdorffii* Kunth var. *langsdorffii,* these 2 collections were components of 2 unnamed forms designated by Bentham as variants of *C. langsdorffii.* However, the small stipules, slender petioles, small glands, mem-

branaceous leaflets, and abbreviate pedicels all indicate relationship to *C. tetraphylla* var. *brevipes* (Benth.) Irwin. This suggestion is supported by the range of the latter taxon, which extends into the adjacent states of Piauhí and Goiás. Thus, it would appear that *C. tetraphylla* var. *linearis* is a close relative of *C. tetraphylla* var. *brevipes,* but more xeric in form and restricted to the dry ridges of northeastern Brazil.

BRAZIL, BAHIA: Serra Jacobina, 1836, *Blanchet 2536* (BM, F, NY).

16c. Cassia tetraphylla var. **ventuarensis** Irwin, var. nov.

Holotype (NY): Venezuela, Edo. Amazonas, "montane savanna in cano, Cerro Moriche, Rio Ventuari." *Bassett Maguire, R. S. Cowan, & J. J. Wurdack 30889.* 14 Jan. 1951. Isotype (U).

Planta fruticosa aut suffruticosa erecta aut ascendens, ad 1.5 m alt., simplex aut ramis erectis pubescentibus multis praedita. Stipulae adpressae, persistentes, caulem superiorem partim celantes, cordato-oblongae, acutae 0.5–1.2 cm long., 2.5–4.0 mm lat., glabrae ciliolatae integrae. Petiolus 1.8–3.1 mm long., canaliculo adaxiali pubescente, in pulvino admodum hirsutus, superficie abaxiali pilosa, pilis distaliter directis; rachis 0.3–0.7 brevior quam petiolus, terminaliter aristata. Glans 1 scutellata, 0.3–0.4 mm lat., plerumque depressa at non perspicua. Foliola bijugata, pari superiore paululum longiore, pari inferiore latiore, per pulvinulum parvum arcuatum brunneum aut subflavum 0.4–0.8 mm long. sessilia, oblanceolata, obliqua, pari superiore saepe divergente, glabra firme membranacea aut subcoriacea, 1.2–1.8 cm long., 3.5–6.0 mm lat.; margines integri, saepe distaliter ciliolata, apice rotundato aut obtuso. Flores axillares singulares aut binae; pedicelli flavo-pubescentes, 0.6–1.0 cm long., 0.7 mm crass. dum florentes, usque ad 1.5 cm long., 1.0 mm crass. dum frugideferentes; bracteae 2 ovatae aut late ovatae, 1.0–1.3 mm lat., 0.6–1.0 mm long.; bracteolae oppositae aut quasi oppositae, divergentes, ovatae ad semi-orbiculares, 2.5–3.5 mm long., 2.1–3.0 mm lat.; sepala lanceolata glabra 0.6–1.2 cm long., 2.4–3.3 mm lat.; petala flava, 1.4–1.8 cm long., 1.0–1.5 cm lat.; stamina flava; ovarium subcinereio- aut subflavo-pilosa. Siliqua anguste oblonga 3.0–3.8 cm long., 7.2–8.8 mm lat., valvae planae, flavo-pubescentes, secundum suturas copiose pubescentes. Semina 9–13 levia dura atro-brunnea aut atra, complanata, 3.8–4.9 mm long., 1.6–2.0 mm lat.

Erect or ascending shrub or subshrub to 1.5 m, simple or with numerous erect pubescent branches. Stipules partly obscuring the upper stem, cordate-oblong, acute or less commonly obtuse, 0.6–1.2 cm long, 2.5–4.0 mm broad, glabrous, ciliolate. Petiole 1.8–3.1 mm long, the adaxial groove pubescent, sometimes hirsute on the pulvinus, the abaxial surface pilose with distally-directed hairs; rachis 0.3–0.7 as long as petiole. Gland 1, scutellate, 0.3–0.4 mm broad, usually depressed and obscure. Leaflets bijugate, the superior pair slightly longer, the inferior pair broader, joined to rachis by a small arcuate brown or yellowish pulvinule 0.4–0.8 mm long, oblanceolate, oblique, the superior pair often divergent, glabrous, firmly membranaceous or subcoriaceous, 1.2–1.8 cm long, 3.5–6.0 mm broad; margins often distally ciliolate, the apex rounded or obtuse. Flowers solitary or in pairs; pedicels yellow-pubescent, 0.6–1.0 cm long and ca. 0.7 mm thick in flower, up to 1.5 cm long and 1.0 mm thick in fruit; bracts 2, ovate or broadly ovate, 1.0–1.3 mm long, 0.6–1.0 mm broad; bracteoles nearly or quite opposite, divergent, ovate to semiorbicular, 2.5–3.5 mm

long, 2.1–3.0 mm broad; sepals lanceolate, glabrous, 0.6–1.2 cm long, 2.4–3.3 cm broad; petals 1.4–1.8 cm long, 1.0–1.5 cm broad; ovary grayish- or yellowish-ilose. Pod narrowly oblong, 3.0–3.8 cm long, 7.2–8.8 mm broad, valves flat, yellow-pubescent, copiously so along the sutures. Seeds 9–13, flattened, 3.8–4.9 mm long, 1.6–2.0 mm broad.

Chromosome number: not determined.

Distribution: Venezuela, in the drainage of the upper Orinoco. Known from the type locality and vicinity, and from near the Río Atabapo; 1000–5000 feet elevation. Occurring in montane savannas and slopes and along water courses.

The first and, as yet, only collections of this variety were made in 1951 in Amazonas, the southermost state of Venezuela. The designated type is in fact the second collection, the first, *Maguire, Cowan,* and *Wurdack 30869,* having been made the previous day in the same area, but consisting of a single sterile branch and a few detached pods.

C. tetraphylla var. *ventuarensis* shows affinity to *C. tetraphylla* var. *tetraphylla* in regard to stipule size and leaflet form, and to *C. tetraphylla* var. *brevipes* (Benth.) Irwin in regard to pedicel and fruit characters. These latter taxa are all known from nearby stations, i.e. ca. 40 miles and 65 miles, respectively. Var. *ventuarensis* is readily distinguished from them by its fastigiate habit, the short petiole and rachis, and the diverging superior leaflets.

VENEZUELA: Between Río Atabapo and La Esmeralda, 4 July 1951, *L. Croizat 54* (NY); Cerro Moriche, Río Ventuari, 13 Jan. 1951, *B. Maguire, R. S. Cowan,* and *J. J. Wurdack 30869* (NY); Cumbre, Cerro Moriche, Río Ventuari, 15 Jan. 1951, *B. Maguire, R. S. Cowan,* and *J. J. Wurdack 30921* (NY) ; Caño Guaviarito, Río Manapiare, Río Ventuari, 4 Feb. 1951, *B. Maguire, K. D. Phelps, C. B. Hitchcock,* and *G. Budowski 31767* (NY) .

16d. **Cassia tetraphylla** var. **aurivilla** Irwin, var. nov.

Photograph of holotype (of *C. brevipes* DC.) examined (F): "Panamaïde." *Lagasca s.n.* (in DC. Prodr. 2 (2): 501: "v.s. comm a cl. Lagasca.")

Cassia brevipes DC., in Collad Hist. Cass., p. 119. 1816. non *C. desvauxii* var. *brevipes* vel. *C. tetraphylla* var. *brevipes* (Benth.) Irwin.
Chamaecrista brevipes (DC.) Greene, Pittonia 4: 31. 1899.

Shrub or subshrub with few to numerous erect or ascending yellow-pubescent branches to 1.5 m. Stipules lanceolate- to deltoid-cordate, acute or acuminate, 3.5–8.8 mm long, 2.0–3.7 mm broad, glabrous, ciliolate. Petiole 2.5–4.7 mm long, pubescent; rachis 0.7–1.0 as long as petiole. Gland 1, scutellate, often somewhat ovoid, 0.6–1.2 mm broad, sessile, often depressed. Leaflets bijugate, subequal or the superior pair slightly longer, joined to rachis by a small linear or arcuate brown or yellowish pulvinule ca. 1.0 mm long, lanceolate, usually somewhat inflexed, basally auriculate, glabrous or lightly puberulent, firmly membranaceous or subcoriaceous, 1.5–3.4 cm long, 5.0–9.2 mm broad, often light or yellow green; margins frequently distally ciliolate, the apex broadly acute or obtuse and mucronate, rarely rounded. Flowers solitary or in pairs; pedicels yellow-pubescent, 1.5–6.0 mm long and ca. 0.4 mm thick in flower, up to 8.2 mm long and 0.8 mm thick in fruit; bracts 2, ovate, 1.5–2.0 mm long, 0.9–1.5 mm broad; bracteoles nearly or quite opposite, usually divergent, broadly lanceolate or ovate, 2.4–3.0 mm long, 1.3–2.2 mm broad; sepals

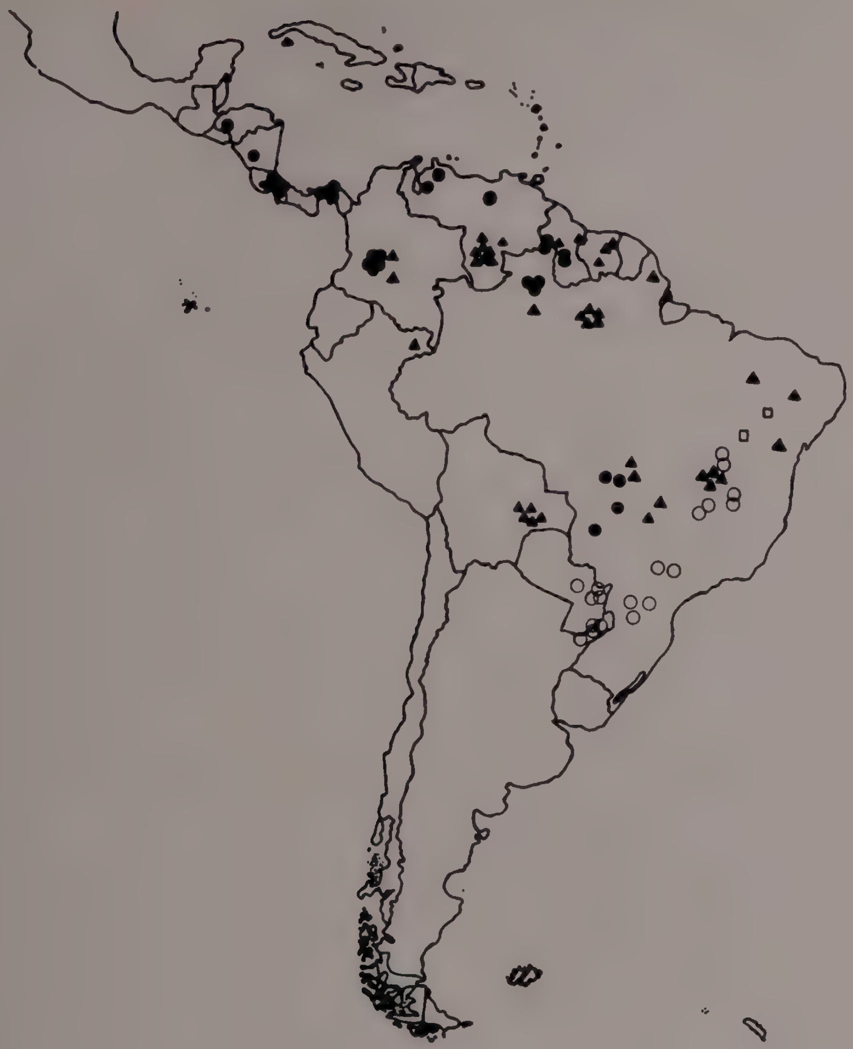

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Fig. 350. Map showing distribution of *C. tetraphylla* var. *aurivilla* (closed circles), *C. tetraphylla* var. *brevipes* (closed triangles), *C. tetraphylla* var. *mollissima* (open circles), and *C. tetraphylla* var. *linearis* (open squares).

lanceolate, glabrous, 0.9–1.4 cm long, 2.1–3.2 mm broad; petals 1.4–2.1 cm long, 1.0–1.7 cm broad; ovary densely yellow-pilose or -hirsute. Pod oblong, 2.4–3.6 cm long, 1.0–1.4 cm broad, valves usually flat, copiously yellow-hirsute. Seeds 13–17, compressed, 0.7–0.9 cm long, 1.2–1.4 mm broad.

Chromosome number: not determined.

Distribution: Nicaragua, southward to Colombia, thence eastward through

Venezuela and the Guianas to Pará, southward to Mato Grosso. Occurring in open woods and savannas, mainly on sandy soils, from 1000–5000 feet elevation.

This taxon is distinguished from *C. tetraphylla* var. *brevipes* (Benth.) Irwin mainly by characters of the fruit, a situation which makes determination of nonfructiferous specimens difficult, but also by the generally broader leaflets, shorter stipules, and pilose ovary. Since fructal characters are required for certain determination, exsiccatae lacking fruit but otherwise agreeing with this taxon will be indicated with an asterisk (*).

Varietal status is deemed appropriate not only because of the overall morphological similarity to *C. tetraphylla* var. *brevipes,* but also in view of evident intergradation with that variety, which in turn intergrades with both *C. tetraphylla* var. *mollissima* (Benth.) Irwin and var. *tetraphylla.* All 4 taxa have regions of sympatry and it is in these regions that intergrading characters appear.

Although *C. tetraphylla* var. *aurivilla* is cited by Bentham (1871) from Panama and Costa Rica, and by Britton and Killip from as far south as Venezuela and British Guiana, it is quite clear from the materials now available, and from field observations by the present author, that its range extends across the Amazon to the Brazilian Shield. As with *C. tetraphylla* var. *brevipes* and to some extent with *C. tetraphylla* var. *tetraphylla,* this extension involves a disjunction across the forested low-altitude portion of the Amazon drainage, but material from both north and south of this region is quite homogeneous and shows about the same degree of variability.

BRAZIL, MATO GROSSO: Santa Anna da Chapada, 1 May 1903, *G. Malme s.n.* (S); Cuyabá, 2 Jan. 1894, *G. Malme 1350B* (BM, S); Santa Anna da Chapada, 25 Feb. 1894, *G. Malme 1350B** (S); Near source of the Rio Paraguay (Rio Amolar), May 1927, *D. Smith 174* (K). RIO BRANCO: Campo de Aviacão, Bôa Vista, 16 Aug. 1951, *G. A. Black 51–12616* (NY, SI); Estrada que passa por Mecejana, Bôa Vista, 29 Aug. 1951,*G. A. Black 51–13064* (SI); in campis altis, Bôa Vista, 24 Aug. 1942, *A. Ducke 1599* (GH, MG, NY, SI).

BRITISH GUIANA: Quimatta, Rupununi River, Sept. 1894, *G. S. Jenman 6779* (K, U); w/o locality, w/o date, *Robt. Schomburgk 190* (K); Pirara, 1841–1842, *Robt. Schomburgk 447** (BM, K, NY).

COLOMBIA: Llanos de Cumaral in And. Orient. Bogota, 6 Jan. 1876, *Ed. Andre 1190* (K); Río Casanare, Esmeralda, 19–20 Oct. 1938, *J. Cuatrecasas 3813* (US); Villa-vicencio, Apiai, El Meta, 12 Nov. 1938, *J. Cuatrecasas 4735* (US); Nocaimà, Hacienda Tobia, Cundinamarca, 15–20 Jan. 1942, *H. Garcia Barriga 10575* (US); Sabanas de San Juan de Arama, margen izquierda del Río Güejar, Meta, 22 Jan. 1951, *M. Idrobo* & *R. E. Schultes 1255* (US); Llano de San Martin Apiai, Jan. 1856, *Herb. J. J. Triana 395* (BM).

COSTA RICA: Río del Pais, w/o date, *Herb. Delessert s.n.* (F, MICH); Paraiso, July 1919, *C. H. Lankester 321* (F, K); Inter Favis (?) et Pacaca, 1845–1848 (–1851?), *Oersted 4956* (F, K); In monte Catalina, 1845–1848, *Oersted 4957* (F); Vicinity of El General, Jan. 1936, *A. F. Skutch 2461* (GH, MICH, S); Buenos Aires, Canton de Osa, 26 Dec. 1933, *M. Valerio 862* (F).

HONDURAS: Near Agua Azul, Cortes, 27 Dec. 1946, *L. O. Williams* & *A. Molina R. 11301* (F).

NACARAGUA: La Esperanza, Río Grande, Zelaya, 11 Apr. 1949, *A. Molina R. 2146* (F).

PANAMA: w/o locality, 1851, *Duchassaing s.n.* (F, P); El Valle, 18 Nov. 1945, *D. Harvey 5176* (F); Prope urb. Panama, Nov. 1846 (?), *Seeman 2071* (K); In savannahs near Panama. w/o date, *Seeman s.n.* (BM).

VENEZUELA: Tocuyo, Lara, Sept. 1910, *A. Jahn 170* (US); Vicinity of Mene Grande, Zulia, 27 Oct. 1922, *H. Pittier 10552* (GH, NY, US); Parguasa, Bolívar, 17 Apr. 1946, *I. Velez s.n.* (US).

16e. Cassia tetraphylla var. **brevipes** (Bentham) Irwin, comb. nov. Isotype examined (K): Brazil, Goiás, "Rio Lage in Serra da Chrystaes." Pohl 843. 1818.

Cassia desvauxii var. *brevipes* Benth., in Mart. Fl. Bras. XV (II): 157. 1870.

Cassia desvauxii var. *stipulacea* Pilger, Eng. Both. Jahrb. 30: 158. 1901. Isotype examined (US): Brazil, Mato Grosso, "zerstreut am Rande des Uferwaldes am oberen Ronuro." *Pilger 621.* May 1899.

Chamaecrista lehmannii Britt. & Rose, Ann. N.Y. Acad. Sci. 35: 184. 1936. Holotype examined (NY): Colombia, "Guagua, Huila." *F. C. Lehmann 1095,* w/o date (collected in Colombia 1880–1899).

Shrub or subshrub to 1.5 m, simple or with few to numerous ascending or erect branches, the young branches puberulent or pubescent. Stipules lanceolate- to ovate- or deltoid-cordate, acute or acuminate, 0.5–1.1 (–1.3) cm long, 2.0–3.2 mm broad, puberulent or glabrous, often ciliolate. Petiole 2.5–6.0 mm long, finely pubescent; rachis 0.3–0.5 as long as petiole. Gland 1, scutellate, 0.3–0.6 mm broad, often somewhat depressed. Leaflets bijugate, the superior pair usually slightly longer, joined to rachis by a small linear, arcuate, or semi-orbicular black or brown pulvinule 0.4–1.0 mm long, linear to lanceolate, straight or slightly inflexed, glabrous or puberulent, firmly membranaceous or sometimes subcoriaceous, 1.9–3.0 cm long, 3.0–7.9 mm broad; margins often distally ciliolate, the apex acute or obtuse and mucronate. Flowers solitary, rarely in pairs; pedicels finely pubescent, 2.0–1.2 (–2.4) cm long and ca. 0.4 mm thick in flower, up to 1.5 (or 3.0?) cm long and 0.8 mm thick in fruit; bracts 2, ovate or deltoid, 1.4–1.7 mm long, 0.8–1.3 mm broad; bracteoles nearly or quite opposite, usually divergent, broadly lanceolate or ovate, 2.9–3.8 mm long, 1.5–2.6 mm broad; sepals lanceolate, glabrous, 1.5–2.1 cm long, 3.2–4.2 mm broad; petals 1.7–2.4 cm long, 1.3–2.0 cm broad; ovary yellow- or gray-pubescent. Pod narrowly oblong, 2.7–3.5 cm long, 4.5–5.5 mm broad, valves usually flat, finely pubescent. Seeds 10–16, compressed, 3.5–4.0 mm long, 1.0–1.4 mm broad.

Chromosome number: not determined.

Distribution: Colombia, eastward through Venezuela and the Guianas to Pará, southward to Goiás, Mato Grosso, and Bolivia. Occurring in savannas and low open woods, mainly on sandy soils, from 500–3000 feet elevation.

The present concept of *C. tetraphylla* var. *brevipes* differs from that of Bentham in 2 ways. First, and as has been mentioned in connection with *C. langsdorffii* Kunth, *Spruce's 3646* from the Orinoco and numerous additional collections since made in that area, especially on the Esmeralda savannahs of the state of Amazonas, Venezuela, are relegated to the present taxon and not to *C. langsdorffii*. This treatment is justified on the basis of complete morphological agreement of this material with that of *C. tetraphylla* var. *brevipes* from adjacent areas in all respects save habit. The Orinoco plants are often strictly erect and sometimes unbranched.

The second difference involves the inclusion of *Chamaecrista lehmannii* Britt. & Rose of Colombia, which differs only in having longer pedicels (maximum lengths indicated parenthetically in the above description). Since pedicel length exhibits considerable variation throughout the range of this variety, there would seem no good reason to exclude *Ch. lehmannii* on this basis.

C. desvauxii var. *stipulacea,* a minor variant, differs only in having slightly longer stipules (to 1.3 cm) and somewhat more copious pubescence on the legume.

Typification of this taxon is based on Bentham's first citation in his original description in Flora Brasiliensis. It is not clear why he excluded *Burchell 8943,* an earlier collection from the same region in Goiás, which agrees in every detail with Pohl's material, but which he referred to *C. desvauxii* Collad. Evidently there was considerable confusion in Bentham's mind over the status of this taxon, not only stemming from his confounding it with *C. langsdorffii,* but also concerning his apparent doubt about its existence as a natural entity, as indicated by his placing a query before the name in his monograph. Presently available material clearly indicates its existence, but intergrades with *C. tetraphylla* var. *aurivilla* Irwin (e.g. *Burchell 8986*) and *C. tetraphylla* var. *tetraphylla* (e.g. *Pearce s.n.* from Bolivia) do occur.

BOLIVIA: Flat tops of sandstone hills, Santa Cruz, Feb. 1950, *M. Cárdenas 4473* (US); Canton Buena Vista, Sara, 18 June 1916, *J. Steinbach 2014* (SI); Campo Banado, Buena Vista, Sara, 16 Feb. 1920, *J. Steinbach 5241* (GH); Chacras de Buena Vista, Sara, 8 July 1924, *J. Steinbach 6200* (GH); Campos de Buenavista, Sara, 14 Aug. 1924, *J. Steinbach 6337* (BM, F).

BRAZIL, AMAPA: Porto Platón, Rio Araguarí, 3 Feb. 1955, *J. M. Pires* & *N. T. Silva 4779* (NY). BAHIA: Caatinga, Junco (?), 1914, *Leutzelburg 201* (NY). CEARA: Serra de Araripe, Feb. 1859, *Gardner 2412* (BM); w/o locality, w/o date, *Schuch 95* (?) (NY). GOIAS: Funil—São João, w/o date (1828—9), *Burchell 8943* (K); Funil—São João, w/o date (1828—9), *Burchell 8986* (K); Funil—São João, w/o date (1828—9), *Burchell 9038* (GH, K); 102 km SE of Caiaponha on road to Jataí, 4 Feb. 1959, *H. S. Irwin 2580* (MICH, NY, R, TEX, UC, US, VIC). MATO GROSSO: Mattogrosso, July 1892, *O. Kuntze s.n.* (NY, US). PARA: Campos de Ariramba, 9 Dec. 1910, *A. Ducke 11395* (BM); Campos de Ariramba, Rio Trombetas, 30 June 1912, *A. Ducke 11870* (BM, MG); Coary, campo da Frequezia Velha, 14 Dec. 1912, *A. Ducke 12386* (MG) ; Campo do Mutúm, Ariramba, Rio Trombetas, 28, May 1957, *W. A. Egler 333* (MG) ; Mutúm, Rio Cuminá Miri, Rio Trombetas, 28 May 1957, *W. A. Egler 370* (MG); Pará, w/o date, *Herb. Persoon s.n.* (P). RIO BRANCO: Vista Alegre, Rio Brânco, Mar. 1913, *J. G. Kuhlmann 2892* (S, U) .

BRITISH GUIANA: Berbice, Apr. 1925, *R. A. Altson 109* (K, U); Frechal, Mount Roraima and vicinity, 6 Sept. 1927, *G. H. H. Tate 27* (NY).

COLOMBIA: Cerro Kañendá, Río Kubiyú, Vaupés, 10 Nov. 1952, *R. E. Schultes* & *I. Cabrera 18330* (NY, SI, US); Boca de Monte, Llanos de San Martín, Meta, 16 Aug. 1950, *S. G. Smith* & *J. M. Idrobo 1414* (F, MO, UC, US).

PERU: Pata, Dec. 1864, *R. Pearce s.n.* (K).

SURINAM: Zanderij-complex, 31 July 1952, *J. G. P. Dirven LP 306* (U); Zanderij-complex, 31 July 1952, *J. G. P. Dirven LP 307* (U); Poika Savannah, 4 July 1951, *A. T. Semple 375* (US).

VENEZUELA: La Esmeralda, 17 July 1951, *L. Croizat 191* (NY); West from Santa Barbara for about 5 km, Río Orinoco and Río Ventuari junction, 23 Feb. 1951, *B. Maguire, R. S. Cowan,* & *J. J. Wurdack 32071—B* (NY); Esmeralda savannah, 23 Mar. 1953, *B. Maguire* & *J. J. Wurdack 34636* (MO, NY, UC); Maypures, June 1854, *R. Spruce 3646* (K); Sabana Grande, at southern base of Cerro Duida, 23 Aug. 1944, *J. A. Steyermark 57861* (F, MO); Esmeralda, Upper Orinoco, 15 May 1942, *L. Williams 15383* (F, US); Esmeralda, Upper Orinoco, 15 May 1942, *L. Williams 15407* (F, US) ; Esmeralda, Upper Orinoco, 16

May 1942, *L. Williams 15440* (F, SI, US); Caño San Miguel, Río Guainia, June 1942, *L. Williams 16173* (F, MO, SI, US).

16f. Cassia tetraphylla var. **mollissima** (Bentham) Irwin, comb. nov.
Holotype examined (K): Brazil, "Prov. S. Paulo and Rio." *Weir 205.* 1861–1862.

Cassia desvauxii var. *mollissima* Benth., in Mart. Fl. Bras. XV (II): 157. 1870.

Shrub or subshrub to 1.5 m, with few to many erect or ascending velvety-pubescent branches. Stipules cordate-ovate, acuminate, 4.2–9.5 mm long, 2.8–6.0 mm broad, pubescent. Petiole 3.0–4.6 mm long, velvety-pubescent; rachis 0.3–0.6 as long as petiole. Gland 1, scutellate, often ovate, 0.7–1.2 mm broad (or long), sessile, sometimes depressed. Leaflets bijugate, the superior pair larger, joined to rachis by a small arcuate brown or yellowish pulvinule ca. 1 mm long, obovate or less commonly oblanceolate, oblique at base, straight or slightly inflexed, velvety-pubescent, firmly membranaceous, 1.1–2.5 cm long, 0.5–1.2 cm broad, often yellow-green; apex rounded or obtuse and frequently mucronate. Flowers solitary or in pairs; pedicels straight, velvety-pubescent, 1.3–2.1 cm long and ca. 0.4 mm thick in flower, up to 2.6 cm long and 0.7 mm thick in fruit; bracts 2, ovate, 0.9–1.2 mm long, 0.5–0.7 mm broad; bracteoles subopposite or remote, lanceolate, 2.3–2.9 mm long, 1.0–1.3 mm broad; sepals lanceolate, glabrous within, puberulent without, 0.8–1.7 cm long, 3.0–5.1 mm broad; petals 1.8–2.2 cm long, 1.3–1.8 cm broad; ovary yellow- or gray-pubescent. Pod narrowly oblong, 3.4–4.5 cm long, 4.5–7.0 mm broad, the valves flat, yellow-pubescent, copiously so along the sutures. Seeds 15–22, flattened, 3.8–4.9 mm long, 1.2–1.5 mm broad.

Chromosome number: $n = 7$.

Distribution: Brazil, from central and western Minas Gerais and southern Goiás southward to Paraná, and in adjacent Paraguay and Misiones, Argentina. Occurring in savannas and low open woods, at 1000–3000 feet elevation.

Morphologically, *C. tetraphylla* var. *mollissima* appears quite uniform over most of its range, except possibly in Argentina; the 2 collections examined from there have unusually narrow leaflets. This taxon closely approaches *C. tetraphylla* var. *tetraphylla* in Paraguay and Paraná in all characters save pubescence. Elsewhere the taxa seem quite distinct.

ARGENTINA: San Ignácio, Posadas, 14 Jan. 1908, *E. L. Ekman 1754* (NY, S); Loreto, Posadas, 31 Jan. 1908, *E. L. Ekman 1755* (NY, S); Loreto, Misiones, Mar. 1952, *R. Martinez Grovetto 3224,* (SI); San Ignacio, Misiones, 12 Feb. 1900, *Hicken 188* (SI).

BRAZIL, GOIAS: Ad Serra ad Congo de Jarapá, w/o date, *Pohl 939* (NY); 82 km NE of Rio Verde on road to Jandaia, 5 Feb. 1959, *H. S. Irwin 2853* (MICH, NY, R, TEX, UC, US, VIC). MINAS GERAIS: 51 km W of Uberlândia on road to Tupaciguara, 1 Feb. 1959, *H. S. Irwin 2536* (MICH, NY, R, TEX, UC, US, VIC); 82 km S of Paracatú on road to Patos de Minas, 9 Feb. 1959, *H. S. Irwin 2612* (MICH, NY, R, TEX, UC, US, VIC); Ituiutaba, 6 Feb. 1949, *A. Macedo 1596* (MO, SI, US); In campis St. Carlos, Jan. 1834, *Riedel 1963* (US). PARANA: Inter Itararé et Jordão, 26 Apr. 1911, *P. Dusén s.n.* (S); Jaguariahyva, 5 Feb. 1910, *P. Dusén 9198* in part (GH, MO, S); Jaguariahyva, 15 Jan. 1915, P. *Dusén 16409* (GH); Jaguariahyva, 1 Feb. 1915, *P. Dusén 16602* (S); Tibagí, Fda. Monte Alegre, Harmonia. 22 Feb. 1953, *G. Hatschbach 3023* (SI). SAO PAULO: w/o locality, w/o date, *Burchell 5595* (K); Rubião Junior, 16 Feb. 1920, *G. Gehrt 3649* (NY)

PARAGUAY: In regione Yerbalium de Maracayú, 1898–99, *E. Hassler 5812* (BM); In regione fluminis Carimbatay, Dec. w/o year, *E. Hassler 5812* (F, GH, NY, P, UC); Vista Alegre, Alto Paraguay, Feb. 1922, *T. Rojas 4197a* (SI); Pedro Juan Caballero, Sierra de Amambay, Mar. 1934, *T. Rojas 6904a* (SI).

16g. **Cassia tetraphylla** var. **littoralis** Irwin, var. nov.

Holotype (NY): Brazil, Guanabara, "vicinity of Cabo Frio." *J. N. Rose & P. G. Russell 20695.* 8 Aug. 1915. Isotype (US).

Planta fruticosa aut suffruticosa ad 1 m alt. ramis procumbentibus ascendentibusve, glabris puberulentibusve, saepe e caule radices agentibus. Stipulae adpressae persistentes late lanceolatae ovataeve, acutae acuminatae, raro obtusae, 0.6–1.4 cm long., 3.0–6.5 mm lat., glabrae integrae. Petiolus 3.5–6.7 mm long., puberulens pubescensve, superficie abaxiali interdum parce pilosa, pilis distaliter directis; rachis aeque longa ac petiolus aut 0.7 brevior, terminaliter aristata. Glans 1 scutellata aut non profunde urceolata, 0.2–0.5 mm lat., sessilis aut depressa obscuraque. Foliola bijugata, raro trijugata, paribus subaequis aut pari superiore paululum maiore, per pulvinulum parvum arcuatum atrum brunneumve c. 0.7 mm long. sessilia, oblanceolata ovatave ad suborbicularia, recta, ad basim obliqua, glabra, interdum glauca, firme membranacea, 1.1–2.0 cm long., 4.2–11.3 mm lat.; margines integri, saepe distaliter undulati, apice rotundato aut late obtuso. Flores axillares, singulares aut binae, in surculis horizontalibus valde secundae; pedicelli recti aut sursum arcuati, puberulentes aut raro glabri, 2.2–3.0 cm long., c. 0.5 mm crass. dum frugiferentes; bracteae 2, late lanceolatae aut ovatae, 1.6–2.4 mm long., 0.9–1.6 mm lat.; bracteolae suboppositae, adpressae, lineari-lanceolatae, 1.9–2.6 mm long., 0.4–0.9 mm lat.; sepala lanceolata glabra 0.7–1.3 cm long., 2.5–3.2 mm lat.; petala flava 1.4–1.7 cm long., 1.1–1.5 cm lat.; stamina flava; ovarium cinereo-sericeum. Siliqua anguste oblonga, 3.0–4.4 cm long., 5.7–6.8 mm lat., superficies super semina quasi cristata, parce puberulens, suturis copiosius puberulentibus etiam pubescentibus. Semina levia dura atro-brunnea aut atra complanata, 3.4–4.9 mm long., 1.1–1.5 mm lat.

Shrub or subshrub to 1 m with procumbent or ascending branches, glabrous or puberulent, often stem-rooting. Stipules broadly lanceolate or ovate, acute or acuminate, rarely obtuse, 0.6–1.4 cm long, 3.0–6.5 mm broad, glabrous. Petiole 3.5–6.7 mm long, puberulent or pubescent, the abaxial surface sometimes sparsely pilose with distally-directed hairs; rachis 0.7–1.0 as long as petiole. Gland 1, scutellate or shallowly urceolate, 0.2–0.5 mm broad, sessile or depressed and obscure. Leaflets bijugate, rarely trijugate, the pairs subequal or the superior pair slightly larger, joined to rachis by a small arcuate black or brown pulvinule ca. 0.7 mm long, oblanceolate or obovate to suborbicular, straight, oblique at base, glabrous, sometimes glaucous, firmly membranaceous, 1.1–2.0 cm long, 4.2–11.3 mm broad; margins often distally undulate, the apex rounded or broadly obtuse. Flowers solitary or rarely in pairs, strongly secund on horizontal shoots; pedicels straight or arching upward, puberulent or rarely glabrous, 2.2–3.0 cm long and ca. 0.5 mm thick in flower, up to 5.5 cm long and 1.0 mm thick in fruit; bracts 2, broadly lanceolate or ovate, 1.6–2.4 mm long, 0.9–1.6 mm broad; bracteoles subopposite, appressed, linear-lanceolate, 1.9–2.6 mm long, 0.4–0.9 mm broad; sepals lanceolate, glabrous, 0.7–1.3 cm long, 2.5–3.2 mm broad; petals 1.4–1.7 cm long, 1.1–1.5 cm broad; ovary gray-sericeous. Pod narrowly oblong, 3.0–4.4 cm long, 5.7–6.8 mm broad, faces somewhat sulcate between the seeds, glabrate or sparingly puberulent, the sutures more copiously puberulent or even pubescent. Seeds 8–15, flattened, 3.4–4.9 mm long, 1.1–1.5 mm broad.

Chromosome number: not determined.

Distribution: Brazil, from Bahia southward along the coast to Santa Catarina. Occurring in coastal dunes, meadows, and restingas in sandy soil.

This taxon is distinguished from other members of the *C. tetraphylla* complex by its low habit, frequent adventitious rooting, stipule size, small glands, and thinner leaflet blades. Its distribution in Espirito Santo is presumptive; as yet no material from that state has been seen. The poorly documented Bahia exsiccatae are imprecisely labelled with respect to locality, but morphologically agree with this taxon.

According to Urban's biographical notes about Sellow in Flora Brasiliensis (Martius 1906) , the type was collected in the vicinity of Rio de Janeiro. Material subsequently collected at Rio, and especially further east at Cabo Frio, has, in general, broader leaflets and longer pedicels. In material from the southern part of this taxon's range, particularly in Santa Catarina, the leaflets are generally larger, more nearly approaching the maximum foliolar dimensions given in the description. Bahia exsiccatae have uniformly lanceolate, often thicker leaflets, also averaging somewhat longer then in those of the Rio material. The uniformity of these characters in their respective areas suggests the existence of a number of isolated populations.

Unlike the case in *C. ramosa* Vog., there is no geographical contiguity between *C. tetraphylla* var. *littoralis* and any other component of the *C. tetraphylla* complex. Throughout most of the range of this variety, the disjunction between it and inland populations of other infraspecific taxa of *C. tetraphylla* spans not only a distance of 100 miles or more, most of it heavily forested, but also an escarpment involving an altitudinal change of 1000 feet or more. Only in parts of Bahia is there geographical contiguity between the inland and littoral habitats favored by *C. tetraphylla* var. *littoralis* and other taxa, but in this region collections are so few and data so fragmentary that no certain statement can be made.

BRAZIL: w/o locality, w/o date, *W. Boaz s.n.* (K); Brasilia tropica, 1835, *Boaz* (Hooker) (K); Minas? (probably in error), w/o date, *Moricand 2168* (K); w/o locality, w/o date, *Herb. Regnell s.n.* (S); w/o locality, 1815–17, *Sellow s.n.* (BM); w/o locality, 1827, *Herb. Martius s.n.* (BM); w/o locality, w/o date, *Sellow 565* (?) (BM). BAHIA: Provincia Bahia, 1839, *Blanchet 2168* (BM, K) ; w/o locality (Bahia) , 1842, *Glocker 479* (BM, US) ; w/o locality (Bahia), w/o date, *Salzmann s.n.* (K, MO); Bom Jesus, Rio de Loutar ?, Aug. 1913, *Leutzelberg 304* (F). PARANA: Guaratuba, in arenosis littoreis, 3 Jan. 1912, *P. Dusén 13528* (S). RIO DE JANEIRO (REPRESENTATIVE SPECIMENS): Rio de Janeiro, w/o date, *W. J. Burchell 1092* (K); w/o locality (Rio de J.) w/o date, *Gardner s.n.* (BM); Restinga de Tijuca, 2 Jan. 1876, *A. Glaziou 6181* in part (BM, MG, S); Brasilia prope Rio, 1829, *Luschnath s.n.* (S) ; Prov. Rio Jan., 1845, *John s.n.* (S) ; Restinga de Itapeba (Recreio dos Bandeirantes) ao nivel do mar, 12 Nov. 1950, *F. Segadas-Vianna 3598* (TEX); Near Barra de São João village, Casamiro de Abreu Co., 27 May 1953, *F. Segadas-Vianna, L. Dau, W. T. Ormond, G. C. Machline, & J. Loredo Jr. 339* (TEX); Pontal beach, Arraial do Cabo, Cabo Frio Co., 11 July 1953, *F. Segadas-Vianna, L. Dau, W. T. Ormond, G. C. Machline, & J. Loredo Jr. 467* (TEX) ; Road between Araruama lagoon and the main road Cabo Frio—Arraial do Cabo, Cabo Frio Co., 16 Aug. 1953. *F. Segadas-Vianna, L. Dau, W. T.*

Ormand, C. C. Machline, & J. Loredo Jr. 856 (TEX); Pontal beach, Arraial do Cabo Frio Co., 11 July 1953, *F. Segadas-Vianna, L. Dau, W. T. Ormond, G. D. Machline, & J. Loredo Jr. 1017* (TEX); Praia do Pontal, Mun. Cabo Frio, 17 Apr. 1952, *L. B. Smith, A. Magnanini, S. L. Oliveira e Silva, L. Dau, W. T. Ormond, Z. Lopes da Silva 6611* (SI, US). SANTA CATARINA: Palhoça, Campo Massimabú, 19 Dec. 1952, *P. R. Reitz 4928* (US); Palhoça, Campo Massimabú, 12 Mar. 1953, *Reitz & Klein 405* (S, US); Palhoça, Campo Massimabú, 14 May 1953, *Reitz & Klein 670* (US). SAO PAULO: Near Santos, w/o date, *Burchell 3125* (K); Praia Grande, São Vicente, 24 Apr. 1949, *D. B. Joly 'C'* (SI); Conceicão de Itanhaem, 24 Apr. 1894, *Loefgren & Edwall 1829* (NY); Sororocabo?, Santos, 20 Dec. 1874, *H. Mosén 2831* (S); Praia Grande, Santos, 10 Jan. 1875,*H. Mosén 3168* (S); São Vicente, Santos, 20 Apr. 1875, *H. Mosén 3616* (S); Road between São Vicente and Itaipú, 25 Feb. 1929, *L. B. Smith 2005* (F, GH, S); Gunrija (?), São Paulo, 13 Jan. 1907, *A. Usteri 93b* (K).

16h. **Cassia tetraphylla** var. **colombiana** Irwin, var. nov.

Holotype (NY): Colombia, Santander, "18 km S of Socorro, in thicket, alt. 1200 m." *H. St. John 20538.* 28 June 1944. Isotypes (MICH, UC, US).

Planta fruticosa aut suffruticosa, ad 1.5 m alt., ramis pubescentibus horizontalibus aut ascendentibus. Stipulae foliaceae adpressae persitentes aut raro caduceae, late lanceolatae aut ovatae, apice acuto obtusove 0.8–1.6 cm long., 3.5–7.8 mm lat., glabrae interdum ciliolatae integrae. Petiolus 4.1–7.8 mm long., canaliculo adaxiali puberulente ad pubescentem aut raro glabrum, superficie abaxiali maxima ex parte pubescente; rachis 0.3–0.5 brevior quam petiolus, terminaliter aristata. Glans 1 scutellata, 0.7–1.2 mm lat., sessilis aut subsessilis. Foliola bijugata, paribus subaequis aut pari inferiore paululum maiore per pulvinulum parvum arcuatum atrum aut brunneum c. 1.0 mm long, sessilia, anguste oblonga aut oblanceolata ad obovata, quasi obliqua, recta aut paulum inflexa, glabra, interdum glauca, firme membranacea aut subcoriacea, 1.4–2.2 cm long., 3.7–9.2 mm lat.; margines integri, interdum distaliter ciliolata, apice rotundato aut raro inflexo-obtuso. Flores axillares plerumque singulares aut in racemis abbreviatis paucas flores habentibus raro occurrentes; pedicelli recti aut sursum arcuati, flavo-pubescentes aut -puberulentes, raro glabri, 2.5–3.8 cm long., c. 0.5 mm crass. dum florentes, usque ad 4.8 cm long., 0.9 mm crass. dum frugentiferes; bracteae 2, late ovatae, 2.0–3.5 mm long., 1.5–3.0 mm lat.; bracteolae suboppositae ovatae divergentes, 4.0–5.8 mm long., 2.4–2.8 mm lat.; sepala lanceolata glabra, 1.0–1.6 cm long., 3.8–5.4 mm lat.; petala flava, 1.8–2.4 cm long., 1.5–2.0 cm lat.; stamina flava; ovarium flavo- aut subcinereo-pilosum. Siliqua anguste oblonga, 3.4–4.8 cm long., 7.0–9.1 mm lat., superficies plana aut super semina non profunde cristata, flavo-hirsuta, secundum suturas copiose hirsuta. Semina levia brunnea aut atro-brunnea, interdum flavo-brunnea, paululum compressa, 4.7–5.3 mm long., 1.7–2.2 mm lat.

Shrub or subshrub to 1.5 m, the pubescent branches horizontal or ascending. Stipules foliaceous, or rarely caducous, broadly lanceolate or ovate, apex acute or obtuse, 0.8–1.6 cm long, 3.5–7.8 mm broad, glabrous, sometimes ciliolate. Petiole 4.1–7.8 mm long, the adaxial groove puberulent to pubescent or rarely glabrate, the abaxial surface mostly pubescent; rachis 0.3–0.5 as long as petiole. Gland 1, scutellate, 0.7–1.2 mm broad, sessile or subsessile. Leaflets bijugate, the pairs subequal or the inferior pair slightly larger, joined to rachis by a small arcuate black or brown pulvinule ca. 1.0 mm long, narrowly oblong or oblanceolate to obovate, somewhat

oblique, straight or very slightly inflexed, glabrous, sometimes glaucous, firmly membranaceous or subcoriaceous, 1.4–2.2 cm long, 3.7–9.2 mm broad; margins sometimes distally ciliolate, the apex rounded or rarely inflexed-obtuse. Flowers usually solitary or rarely in abbreviate few-flowered racemes; pedicels straight or arching upward, yellow-pubescent or -puberulent, rarely glabrous, 2.5–3.8 cm long and ca. 0.5 mm thick in flower, up to 4.8 cm long and 0.9 mm thick in fruit; bracts 2, broadly ovate, 2.0–3.4 mm long, 1.5–3.0 mm broad; bracteoles subopposite, ovate, divergent, 4.0–5.8 mm long, 2.4–2.8 mm broad; sepals lanceolate, glabrous, 1.0–1.6 cm long, 3.8–5.4 mm broad; petals 1.8–2.4 cm long, 1.5–2.0 cm broad; ovary yellow- or grayish-pilose. Pod narrowly oblong, 3.4–4.8 cm long, 7.0–9.1 mm broad, faces flat or shallowly sulcate between the seeds, yellow-hirsute, copiously so along the sutures. Seeds slightly compressed, 4.7–5.3 mm long, 1.7–2.2 mm broad.

Chromosome number: not determined.

Distribution: Western Colombia, Edos. Santander, Caldas, and Cundinamarca, east to Vaupés. Occurring mainly in mountain savannas and low open woods from 1000–5000 feet elevation.

This variety, similar to *C. tetraphylla* var. *tetraphylla* except for the large stipules and the yellow pubescence of floral structures, probably represents the full expression of what was approached by *C. pulchra* H. B. K. However, as is noted under *C. tetraphylla* var. *tetraphylla, C. pulchra,* as conceived by its authors, falls well within the range of variability of *C. tetraphylla* var. *tetraphylla* in northern South America, and therefore is reduced to synonymy under that variety. The present taxon, in addition to its morphological distinctness, is separated from the nearest known populations of *C. tetraphylla* var. *tetraphylla* by an east-west gap of about 400 miles across the Llanos of eastern Colombia. However, it is more or less contiguous with a small localized population of *C. tetraphylla* var. *brevipes* (Benth.) Irwin in Edos. Meta and Vaupés. Intergradation between these taxa is evidently slight for no intermediate variants have been seen, and each retains its own peculiarities in areas of sympatry.

The only significant variation observed in *C. tetraphylla* var. *colombiana* concerns stipule persistence; specimens from Vaupés show stipule loss before leaflet expansion and internodal elongation have been completed. This may be the result of gene exchange with *C. gracilis* Kunth, a species of the upper Orinoco drainage which frequently also has caducous stipules, but as yet there is no clear morphological evidence to support this suggestion.

COLOMBIA: Yapoboda, 10 Dec. 1943, *P. H. Allen 3214* (US); Chinchina, Caldas, 22–29 Nov. 1946, *J. Cuatrecasas 23082* (US); Santandericito, abajo del Salto, Cundinimarca, July 1933, *H. Garcia B. 128* (US); About 1 km S of Floridablance on road to Piedecuesta, Santander, 9 July 1953, *J. H. Lagenheim 326* (US); 5 km al sur de Pie de Cuesta, 16 Dec. 1948, *J. A. Molina* & *F. A. Barkley 18S239* (US, US); 5 km al sur de Pie de Cuesta, 16 Dec. 1948, *J. A. Molina* & *F. A. Barkley 18S240* (US); Mesa de los Santos, Santander, 11–15 Dec. 1926, *E. P. Killip* & *A. C. Smith 15089* (BM, GH, NY, US); Mesa de los Santos, Santander, 11–15 Dec. 1926, *E. P. Killip* & *A. C. Smith 15127* (GH, NY, US); Vicinity of El Roble, Santander, 6 Feb. 1927, *E. P. Killip* & *A. C. Smith 19345* (GH, NY, US); Bucaramanga, Santander, May 1948, *C. Sandeman 5989* (K); Serro Yapoboda, Río Kuduyarí, Vaupés, 5–6 Oct. 1951, *R. E. Schultes* & *I. Cabrera 14362* (NY, US); Cerro Kañendá, Río Kubiyú, Vaupés, 10 Nov. 1952, *R. E. Schultes* & *I. Cabrera 18321* (NY, SI, US); Carretera de Barbosa al Socorro, Santander, July 1944, *L. Uribe 781* (US).

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NUMERICAL LIST OF TAXA

1. *C. cultrifolia*
2. *C. diphylla*
3. *C. latistipula*
4. *C. gracilis*
5. *C. piribebuiensis*
6. *C. piauhiensis*
7. *C. langsdorffii*
    - a. var. *langsdorffii*
    - b. var. *longipedicellata*
    - c. var. *latifoliola*
    - d. var. *tenuis*
    - e. var. *parvifoliola*
8. *C. curvifolia*
    - a. var. *curvifolia*
    - b. var. *mollissima*
    - c. var. *lucida*
9. *C. ramosa*
    - a. var. *ramosa*
    - b. var. *maritima*
10. *C. chartacea*
    - a. var *chartacea*
    - b. var. *tenuicaulis*
11. *C. malacophylla*
12. *C. tecta*
13. *C. saxatilis*
14. *C. bartlettii*
15. *C. madrensis*
16. *C. tetraphylla*
    - a. var. *tetraphylla*
    - b. var. *linearis*
    - c. var. *ventuarensis*
    - d. var. *aurivilla*
    - e. var. *brevipes*
    - f. var. *mollissima*
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B.A. KRUKOFF

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MEMOIRS

OF

The New York Botanical Garden

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SUPPLEMENTARY NOTES ON THE AMERICAN SPECIES OF STRYCHNOS. VII

B. A. Krukoff[1]

INTRODUCTION

Our last serial paper on *Strychnos* appeared in print in September, 1950 (7), although for all practical purposes my work on this genus was abruptly terminated on November 27, 1948 with my departure for Guatemala. Since then, abundant new collections have become available and they are cited in this paper. The collections examined extend our knowledge of many species previously known from incomplete material; extensions of ranges are noted for a number of species; six species, namely *S. Blackii*, *S. eugeniaefolia*, *S. Froesii*, *S. Bovetiana*, *S. malacosperma* and *S. oiapocensis*, which were described as new since 1948, are reviewed; three new species, namely *S. colombiensis*, *S. lobelioides*, and *S. Schultesiana* are described; one species, namely *S. mattogrossensis*, which was previously placed by us (1: 315) in synonymy under *S. nigricans*, is now reinstated as a valid species, and one species, namely *S. brachistantha*, is now placed in synonymy under *S. nigricans*.

It has been found desirable to arrange the species in a new order according to their taxonomical relationship, and rewrite all the keys. Thus, since our monograph appeared in print in 1942, thirteen new species have been described, four reinstated as valid and two (*S. hachensis* and *S. brachistantha*) reduced to synonymy. For a list of these, see Appendix I.

Eleven papers on *Strychnos* (7 papers by Ducke, 2 by Froes, 1 by Pires and 1 by Monachine), which appeared in print since 1948, were carefully and critically reviewed. Of these, two papers by Ducke (31, 33) are of particular interest as they are summaries of his uninterrupted interest and work on this genus, both in the field and in herbaria, from 1942 to 1959.

In connection with the preparation of this paper I examined specimens received on loan from nine botanical institutions (Arnold Arboretum, Chicago Natural History Museum, Gray Herbarium, Missouri Botanical Garden, Nichols Arboretum, University of Michigan, U. S. National Herbarium, Herbario Nacional de Venezuela, Royal Botanic Gardens Kew, and Naturhistorisches Museum, Wien) in addition to a very large collection at The New York Botanical Garden, mostly duplicates of specimens from Instituto Agronomico do Norte. These specimens had not been examined and annotated by me previously.

To the directors and curators of the institutions listed above, I wish to express deep obligation. I also take this opportunity to express thanks to Dr. Karl Folkers, Dr. D. Wolf and Miss S. Britcher for their cooperation in preparing a list of papers published as a by-product of a project on paralyzing principles at Merck Sharp & Dohme Research Laboratories. I am indebted to Dr. Max Tishler, Dr. L.

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Sarett and Dr. C. Mushett for their encouragement in collecting samples of Central American species of *Strychnos* for chemical studies of Prof. G. B. Marini-Bettolo (Rome) and Prof. P. Karrer (Zurich). It is the collection that started me on this paper in 1963. I am also indebted to Dr. W. C. Steere and Dr. B. Maguire for allowing me the facilities of The New York Botanical Garden for carrying on this work. As in the past, Mr. N. Y. Sandwith was generous in helping me with information and advice. Special mention should be made of the collaboration of Mr. Rupert C. Barneby. Without his collaboration the publication of this paper would have been delayed as I was pressed for time. Together with him we described two new species. He provided the Latin description of the third new species described in this paper, prepared drawings of flowers, dissected flowers of several especially interesting specimens and read the manuscript and proof.

The place of deposit of specimens is shown by the same abbreviations as in our previous papers on *Strychnos* (1–11). The following new additional abbreviation is used: W: Naturhistorisches Museum, Wien.

In order to conserve space, no place of deposit is indicated when a particular collection was seen from The New York Botanical Garden. The photographs are cited only when the specimens were not seen. If the available material was inadequate for positive identification, then the collection is preceded by an interrogation mark.

Distribution of species was compiled on the basis of 1957 specimens examined and cited in our papers on the genus.

Mature fruits and seeds of only a few species of *Strychnos* were available to us in 1942, at the time when we were working on the monograph. Ducke made a valuable contribution when he published a key based on the fruit characters, and described fruits and seeds of 45 Brazilian species (31, 33). Under each species, I make reference to these descriptions, although I was unable to review these critically. It is very unfortunate that Ducke does not cite the specimens' numbers on the basis of which he described the fruits. A great majority of the fruits which were available to Ducke are deposited with Brazilian institutions (particularly with the Instituto Agronomico do Norte), and these were not available to me. As seen from Ducke's key and descriptions, mature fruits and seeds are very helpful, but only in a few isolated instances. Five species, namely *S. Froesii*, *S. pachycarpa*, *S. malocosperma*, *S. nigricans*, and *S. brasiliensis* (also possibly *S. ramentifera*, *S. Jobertiana*, and *S. Peckii*) can be identified on the basis of their fruits and seeds (the ranges of *S. Grayi* and *S. brasiliensis* do not overlap, but they hardly can be told apart on fruit characters). *S. nigricans* and *S. mattogrossensis* which are very similar in their flower and vegetative characters, as well as *S. rondeletioides*, *S. macrophylla* and *S. Barnhartiana* which are rather close in their flower and vegetative characters, can be easily told apart on their fruit and seed characters. On the other hand, nine species of *Longiflorae* come in the same place in Ducke's key (for details see under *S. Blackii*), whereas six species of *Longiflorae*, eight species of *Intermediae* and four species of *Breviflorae* also come in a single place in the same key (for details see under *S. rondeletioides*). It is now possible to generalize and state that fruits are very similar in all species of *Intermediae* (fruits are not known in *S. Duckei*) and they are very different in some closely related species of *Breviflorae* and *Longiflorae*. On the other hand it is to be recalled that all species of *Intermediae* can be easily distinguished on vegetative characters, whereas some of the species of *Breviflorae* are difficult to distinguish even on flower characters.

References to the use of bark of *Strychnos* in curare and the list of species entering curare as a main or a secondary ingredient, were very carefully compiled on the basis of 1957 specimens examined and cited in our papers on the genus.

The important information on the presence or absence of tendrils or spines, or both, on various species of *Strychnos* was brought up to date.

The references to the alkaloids which were isolated from the bark, and the references to the physiological activities of extracts of bark of various species of *Strychnos*, published since the early thirties, are probably fairly complete.

I also include selected quotations from Fanshawe's paper (34) which gives very useful information on the local names, on the field characters and on the distribution in British Guiana of 12 species of *Strychnos* which occur there; also on their alkaloids, probably on the authority of the late Dr. Harold King. The field descriptions are of particular interest as they were made by a forester with many years of field experience in British Guiana, and it is not hoped that such descriptions will be made for other species of the genus for many years to come. Botanists and botanical collectors seldom describe bark (including color of the slash), by which important timber trees are often identified in the field by foresters.

New species of *Strychnos* are to be expected. It is not likely that any of these will come from the West Indies, Mexico or Central America. The poorly collected subandean Colombia, Ecuador, Peru and Bolivia should provide some novelties, although indications are that subandean species of *Longiflorae* usually have a very wide range. New species of *Breviflorae* (related to *S. Poeppigii*, *S. longisepala* and *S. tarapotensis*) which are not welcome, as even the existent ones are too close for convenience, are expected from Peru. Once the poorly known *S. albiflora*, also *S. acuta* and *S. rubiginosa* of southern Brazil are better understood, it will be easier to guess as to what may be expected from this region. It is from this particular region that a considerable number of sterile specimens are not yet definitely identified. The bulk of novelties likely will come from the southern part of the great basin of the Amazon (basins of the upper Rio Xingu, of Rio Tapajos and also of Rio Madeira), which up to recently was not accessible for botanical collections. The best collected regions in Brazilian Amazonia are the basins of the upper Rio Solimoes, of Rio Negro and of Rio Jurua, as well as the vicinity of Belem. (In the poorly collected basin of Rio Purus, as far as *Strychnos* is concerned, most of the species which were already collected in the basin of Rio Jurua likely will be found.)

For the extension of ranges and for the location of the extreme limits of distribution of various species, the new collections from the regions enumerated below are of particular interest: (1) Pacific Coast of Colombia and Ecuador; (2) French Guiana; (3) subandean Colombia, Peru, Ecuador and Bolivia; (4) basins of the upper Rio Xingu and of the upper Rio Tapajos in the State of Para, Brazil; (5) basin of the Rio Madeira in the State of Amazonas, Brazil; (6) State of Bahia, Brazil, and (7) State of Espirito Santo, Brazil.

Further progress of our knowledge of the American species of *Strychnos*, as in the past, likely will come largely through the efforts of the collectors who are interested in curare and who specifically search for *Strychnos*. As of today five species of *Strychnos* are known from Ecuador, and all of these are known only from the collections of two amateur botanical collectors (R. C. Gill and Charles C. Fuller), who never made any extensive botanical collections but they were interested in curare and were specifically searching for *Strychnos*. Of these five species, *S. toxifera*, *S. Peckii* and *S. Mitscherlichii* were collected by Gill as well as by

Fuller, whereas *S. Jobertiana* and *S. guianensis* only by Gill. As I stated in our monograph (1: 259): ". . . in hunting *Strychnos,* the collector has to rely on his ability to distinguish bush-ropes from other lianas by the bark and wood. Once he is able to do this, the collection becomes a matter of routine." It should be noted here that flowers and fruits of gigantic bush-ropes growing in virgin forests in the Amazon basin usually cannot be seen until the tree to which the bush-rope is attached is cut down. In 1934 I made a very extensive collection in the basin of Rio Madeira, Amazonas, Brazil, in which region at least 17 species of *Strychnos* are likely to be found, and I collected there only three species (*S. amazonica, S. hirsuta* and *S. mattogrossensis*). The reason for this extremely poor performance was that at that time neither Froes, who was with me on the Rio Madeira, nor I knew as yet how to search for *Strychnos* and we learned about this later in 1936 while specifically searching for *Strychnos* on the upper Rio Solimoes. This is quite a contrast with the collection which I made together with Froes in 1936 at which time the material of 18 species (and one variety) were collected in a single locality in the basin of Igarape Belem, a northern tributory of the upper Solimoes, in Munic. São Paulo de Olivença, near the Brazilian-Colombian border (1: 251), and Froes collection in 1946 on the upper Rio Jurua on which trip he collected the material of 17 species (6: 9).

It is to be regretted that years will pass before we will know of the occurrence of *Strychnos* in Southern Venezuela. The very extensive and valuable collections carried on by Maguire et al, for many years in this region, as well as in other countries are poor in species of this genus. From 1943 to date I have only seen 22 collections (which belong to 13 species) collected by Maguire and his coworkers, Cowan, Wurdack and Monachino, Irwin, Silverio Level and others. Of these, seven species (12 collections) were collected in Venezuela, two species (2 collections) in French Guiana, three species (4 collections) in British Guiana, one species (1 collection) in Surinam, and three species (3 collections) in Brazil. Of 15 known species in Venezuela (and four not collected as yet but which doubtless occur), Maguire et al, collected in Venezuela only seven species (namely *S. rondeletioides, S. toxifera, S. Peckii, S. Mitscherlichii, S. guianensis, S. panurensis,* and *S. Fendleri*).

It has been found desirable to divide the literature cited into four parts. The list of papers published as a by-product of a project on paralyzing principles at Merck Sharp & Dohme Research Laboratories is complete. This is divided into two parts and will be helpful to the future students of the three groups of plants yielding paralyzing principles (namely *Strychnos*, certain members of Menispermaceae and *Erythrina*), as well as to the chemists and pharmacologists who are interested in paralyzing principles. The papers, published independently of the above referred to project, are cited only if a reference to these particular papers is made in the text. The place of publication of various species of *Strychnos* is given only for the species which were described as new or reinstated as valid since our monograph appeared in print in 1942. These papers are not listed under "Literature Cited."

For a brief summary on the progress with the American species of *Strychnos* since 1933, when N. Y. Sandwith brought order in the species which occur in British Guiana and Trinidad (38), see under *S. diaboli.* This era was recently terminated with the death of my former field assistant, Ricardo de Lemos Froes, who collected specimens of 42 species and of 1 variety, including 5 types (of 64 known species and 1 variety, Froes did not collect specimens of 22 species; however, 9 of these are not found in Brazil, and 7 are not found in the Amazon basin where he was collecting; whereas of 6 species which occur in the Amazon basin and which Froes did not collect, 5 are known only from a single collection); with the death of Ducke whose limited but very carefully made collections, including those of flowering and fruiting specimens from the same plants, are very valuable and include 6 types; he described 7 new species and did a pioneering job of describing mature fruits and seeds of 45 Brazilian species (31); with the death of G. A. Black and W. A. Egler; and with the departure from the Instituto Agronomico do Norte at Para, first of its Director, a very capable organizer, Dr. F. C. Camargo, and later of the head of the Botany Department, J. Murca Pires. It will be recalled that the search for *Strychnos* was carried on uninterruptedly by the members of this Institute from 1942 to 1960.

Standley is also no longer with us. He made 76 collections and collected all known Mexican and Central American species. The distribution of various species in Northern America, as we know it today, is based largely on his collections. Time and again a sterile unicate carefully chosen by him was found to be of more interest than some fertile specimens from well collected localities, such as, for example, Panama Canal Zone.

My former collaborator, Joe Monachino, is missed. As was the case with Ducke, he never mastered the identification of *Strychnos* on sterile material, probably inasmuch as up to 1956 he never saw *Strychnos* in the field and was never concerned with identification of sterile material. However, this paper doubtless would be better and more complete if he were still with us. We surely would elect to borrow recently collected specimens of *S. Froesii*, and of *S. hirsuta*, and *S. cogens* in flower and specimens of *S. nigricans* from Southern Brazil in fruit and he could check on Ducke's descriptions of these and could rewrite their descriptions along the lines of our other descriptions of *Strychnos*. As I never saw the flowers and/or fruits of the species to which I refer above, I was unable to review critically Ducke's descriptions. Keys would be improved if Monachino would put about three weeks of solid work on these, for which I have no time.

I still hope to be able to publish one additional paper on *Strychnos*, once I have a chance to see specimens which were collected since 1948 and which I have not yet seen (particularly those which are deposited with the Instituto Agronomico do Norte). It would be desirable to review critically Ducke's descriptions of fruits and seeds, and also to see whether we can make further progress in our knowledge of certain species, particularly those which I discuss under problems in the American species of *Strychnos*.

Those of us who were privileged to work and collect extensively in the great basin of the Amazon, without any exception known to me, are, of course, intensely interested in the phytogeography of this region. The most extensive paper on this subject was published by Ducke and Black in 1953 (30). I am toying with the idea that with the additional specimens of *Strychnos* which are already available in various herbaria and which I have not yet seen, it will be possible to prepare charts for certain selected species of *Strychnos*, showing their distribution. It will be recalled that this genus with 64 known species and 1 variety already studied on the basis of 1,957 collections, has its center of distribution in the heart of the Amazon (region of the upper Solimoes, near the border of Brazil, Peru and Colombia, where already 21 species and 1 variety were collected). At least three Amazonian species (namely *S. Peckii*, *S. nigricans*, and *S. darienensis*), reach their northern limit of range in British Honduras, Mexico and Costa Rica respectively;

4 Amazonian species (namely *S. Mitscherlichii, S. Peckii, S. darienensis* and *S. panurensis*), venture into the Pacific coast region of Colombia; several Amazonian species (namely *S. Peckii, S. Mitscherlichii, S. darienensis* and possibly *S. solimoesana*), extend their ranges to the State of Bahia in southern Brazil, and, at least *S. parvifolia,* which occurs in special habitat on the Amazon, occurs as far south as São Paulo in Brazil, Paraguay and Bolivia (savannas of Santa Cruz). There is a group of species (including *S. Castelnaeana, S. javariensis* and *S. Smithiana*) with a rather limited range covering the western part of the State of Amazonas in Brazil and adjacent Peruvian and Colombian Amazonia, and indications are available that there are several species with their ranges confined to the State of Para and/or Territory of Amapa in the Amazon basin, and which occur also in French Guiana. Certain species, such as for example, *S. xinguensis* and *S. asperula,* are now likely known only from the northern limits of their ranges in the southern part of the Amazon basin, and we still do not know how far they extend to the south. Charts for certain selected species of *Strychnos,* showing their distribution to which I refer above, would be helpful in extending our knowledge of the phytogeography of the Amazon basin, as well as to students of other groups of Amazonian plants.

By the end of 1964 I hope to complete the collection of bark samples of Central American species of *Strychnos* for chemical and pharmacological studies. The results of these should be of interest, as none of the Central American species has been previously studied chemically. The chemical studies of seeds which I am now collecting will be of particular interest, as no seeds of American species of *Strychnos,* to my knowledge, were studied chemically to date.

A comparative study of the wood structure of several South American species of *Strychnos* was made by Cockrell (27, 28). His paper helped us to place *S. javariensis* in the correct place next to *S. diaboli* in our monograph (1: 280).

The genus, as it is represented in America, as per its present interpretation, consists of 64 species and 1 variety. I quote Ducke's comments on the genus, with which I am in complete accord (31: 8): "*Strychnos* é um gênero tão natural que escapou até agora ao esfacelamento por parte dos "splitters" que tantas difficuldades têm causado aos botânicos que estudam as plantas "in loco" e vivas. . . . Estou de inteiro acôrdo con Krukoff, em absterme da criação de subspécies e variedades de herbário que em muitas casos corresponderiam apenas a fragmentos de indivíduos. Estudos sôbre a variabilidade das espécies de *Strychnos* só terão valor científico quando baseados em plantas vivas e abundante material de herbário . . ." Of course, it will be recalled that over 40 specific names were reduced to synonymy for the first time in our monograph, also that at least Gilg, who described 15 species as new and none of which was accepted as valid, probably could be considered as a "splitter," at least as far as the American species of *Strychnos* are concerned.

It is regrettable that in all probability neither N. Y. Sandwith nor I (nor of course Ducke who is no longer with us) will have the privilege of enjoying reading the work of a future monographer of the genus and the opportunity of being able to defend the interpretation of certain species, the identification of certain specimens and to prevent, if feasible, the creation of superflous names, particularly of subspecies, varieties and forms.

The work of a future monographer will be facilitated by the extensive collections of *Strychnos* at The New York Botanical Garden and by my very extensive files on the genus, which are now on deposit with the Smithsonian Institution.

Among these is deposited my correspondence with N. Y. Sandwith (including his extensive and very valuable notes written in 1937 on the identifications of extensive collections of *Strychnos* brought by me from Brazil in 1937, which I consider as classic, as far as this genus is concerned, and which should be carefully studied by every student of this group, and to which I refer in the monograph (1: 250), with Ducke, with Froes and many chemists and/or pharmacologists who worked on various American species of *Strychnos* and/or curare from 1937 to 1965.

SPECIES OF STRYCHNOS USED IN THE PREPARATION OF CURARE

In our monograph (1: 248) we stated: ". . . in the course of this revision an attempt was made to verify the identity of *Strychnos* species, the bark of which is used by Indians as either a main or secondary ingredient of curare. Of the species known to date, irrefutable evidence in the form of herbarium material indicates the usage of at least 12 species in this preparation (see remarks under *S. toxifera*, *S. javariensis*, *S. Jobertiana*, *S. solimoesana*, *S. Peckii*, *S. pedunculata*, *S. Mitscherlichii*, *S. guianensis*, *S. subcordata*, *S. cogens*, *S. Melinoniana*, *S. Castelnaeana*, and also under the doubtful *S. Gubleri* and *S. yapurensis*. Of these only *S. toxifera*, certain forms of *S. guianensis* and *S. Castelnaeana* provide the main ingredient."

Since then new evidence is available on the usage of six additional species and variety (see remarks under *S. rondeletioides*, *S. macrophylla*, *S. brachiata*, *S. Erichsonii*, *S. Mitscherlichii*, var. *pubescentior*, *S. glabra*, and *S. panurensis*).

Of these *S. glabra*, also *S. solimoesana*, which previously were reported only as secondary ingredients are now reported, as the main ingredients: the first on the upper Paru, in the State of Para, Brazil by the Trios and by the Roucouyennes (on the authority of Crevaux) and on Rio Icana, in the basin of the upper Rio Negro, in the State of Amazonas, Brazil, by the Baniuas (on the authority of Froes); and the second in the basin of Rio Tonantins, State of Amazonas, Brazil, by the Cauichanas (on the authority of Ducke).

CHEMICAL STUDIES

Work on Strychnine.

Active principles of species of *Strychnos* always attracted the attention of outstanding chemists. In this connection, it is desirable to quote a very colorful account on the work with strychnine by Dr. J. B. Hendrickson, (The Strychnos Alkaloids in R. H. F. Manske's The Alkaloids. Chemistry and Physiology. 6: 179–180. 1960). This should stimulate the search for the American species of *Strychnos* by botanical collectors and explorers, the collection of authentic samples for chemical and pharmacological studies, and their study by chemists and pharmacologists. This paper will be read by botanists, but, unfortunately, for all practical purposes Manske's book is hardly available to them.

"The conquest of strychnine has finally been achieved, after almost a century and a half of prodigious effort. The ultimate conclusion from the herculean assaults of the degradative chemists has now been confirmed in full structural and stereochemical detail with the announcement of the complete delineation by X-ray crystallography . . . and the total synthesis of the molecule (by R. B. Woodward et al.). Throughout virtually the entire historical span of organic chemistry the problem of the structure of strychnine has stood like a massive Everest amongst the challenging peaks of that field and was practically the last of the great classical problems of its kind to yield to the assaults directed against it.

"The immense amount of devoted effort on this problem has been broken down in terms of the number of contributions from each of the major laboratories (by R. Huisgen), a compilation which totals 230 papers in this century alone. A cursory view of the development of the problem may lend perspective to its history and classical stature. The early period (1817–1910), featuring chiefly the work of Tafel, focused attack largely on the left side of the molecule. . . . The classical period (1910–1932) may be said to have started with the entrance into the battle of the English school, brilliantly headed by Sir Robert Robinson, and the forces of Hermann Leuchs in Berlin, who contributed the massive total of 125 papers of outstanding experimental work. The efforts of this period were largely devoted to oxidative incursions into the underside of the molecule. By 1932 the escalade had successfully taken the outer wall of the molecule's defenses, leaving only the inaccessible and silent heart, which, with its singular intricacy of interlaced hydrocarbon rings, was to require sixteen more years of concentrated effort for solution. . . . The final period (1932–1948) was devoted to a search for entree into the center of the molecule, which was finally achieved in the clarification of the reactions of pseudostrychnine (by R. B. Woodward and W. J. Brehm), and the consequent demonstration of the structure of strychnine itself."

CHEMICAL STUDIES OF THE AMERICAN SPECIES OF STRYCHNOS

General.

Various South American species of *Strychnos* are a source of curarizing alkaloids in curare. There are two basic approaches to the study of these active principles: First, studies with native curares, and second, studies starting with the botanical components.

As taxonomists, we are primarily interested in plants and of course also in naturally occurring active principles in the plants, we will omit references to the studies of native curares. These studies are best covered by chemists. It is of course well realized, however, that without the pioneering work carried out on Calabash curares by H. Wieland and his coworkers since the late thirties and the monumental work carried on by Karrer, Schmid and their numerous coworkers[2] since the late forties, not much progress would have been made in the knowledge of the active principles of the American species of *Strychnos*. In order to appreciate the remarkable progress made on the active principles of American species of *Strychnos* since the early thirties it is sufficient to glance at Karrer & Schmid's paper (92) from which it is evident that of 71 alkaloids listed by him (of which 51 alkaloids are now known to occur in species of *Strychnos* and 20 alkaloids so far were found in Calabash curares only)—empirical formulas are given for 44 alkaloids (of which 31 alkaloids are now known to occur in species of *Strychnos* and 13 alkaloids so far were found in Calabash curares only). The structural formula (as far as possible) was proposed for 18 alkaloids (of which 14 alkaloids are now known to occur in species of *Strychnos* and 4 alkaloids in Calabash curares only).[3]

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[2] A complete list of coworkers of Karrer and Schmid who worked with them up to 1957 is given in (92).

[3] In a private communication of Dec. 20, 1963 Prof. P. Karrer wrote to me as follows: "The number of alkaloids from *Strychnos* barks for which structural formulas have been put up, has reached 24 today. Apart from the 18 alkaloids which you mention in your manuscript and which are also referred in J. Ind. Chem. Soc. **38**, #8 (1961) the constitution of six additional alkaloids has been cleared up in the last two years (Akuammicine, C-alkaloid D, Caracurin II, C-fluorocurarine, C-calebassine and C-alkaloid-A)."

This is quite a contrast with what was known on the alkaloids of the American species of *Strychnos* back in 1935 at the time when I was given a commission by Merck Research Laboratories to investigate and obtain authentic materials of plants, entering the curare of the Tecuna Indians of Brazil and which knowledge for all practical purposes was nil. In those days Folkers and Unna, with whom I was associated on the problem with paralyzing principles from the botanical angle, and I were occupied with pioneering tasks which are of little, if any, interest today. Together with A. C. Smith and Moldenke, I was trying to check on the identity of botanical components of various curares, whereas Folkers and Unna were trying to check on the tests of total extracts on frogs, mice, cats and dogs as to what plants are responsible for the paralyzing activity of certain curares and therefore deserve to be studied chemically. At that time, with the exception of diaboline, no active principle had ever been isolated from any American species of *Strychnos*.

As far as I can ascertain, from the references available, of 64 species (and 1 variety) of *Strychnos* known to date, 25 species were studied chemically. They are listed below and I indicated the species from which only traces of alkaloids were isolated and/or of which—the alkaloids were not characterized and/or of which—the total extracts did not show any curare activity.

Studies of Root Bark and Seeds.

It is very regrettable that apparently practically all chemical studies were done on the bark of stems (not on bark of roots!),[4] also that there is no reference in any of the papers as to whether the bark was obtained from the lower part, or from the medium, or from the upper part of the stems. Many of the conflicting results reported on the alkaloids as well as on curare activity of the total extracts of certain species would likely be interpreted more satisfactorily if such records were available and were published. As is the case for example with Cinchona alkaloids, there are strong indications that at least in certain species of *Strychnos* (for details see under *S. Peckii* and *S. guianensis*), the root bark is more rich in alkaloids both qualitatively and quantitatively than the bark of stems, also that the bark of the upper part of stems is much more "poor" than the bark of the lower part of stems.

It is also incredible but it is a fact that up to the present no one has ever studied in detail the seeds of any American species chemically (this in spite of the fact that strychnine and brucine are obtained in 2–3% yields from the seeds of the Asiatic—*S. nux-vomica* and *S. Ignatii*). The total extracts of the seeds and fruit shells of *S. toxifera* were tested by Folkers and Unna (41) and found to be much lower in activity than the bark of stems. Total extracts of fruits (not seeds!) of the same species were found to be free of paralyzing activity by King. Boehm is said to have tested some seeds of a South American species of *Strychnos* and found no alkaloids, but this study is of little interest as it is not possible to trace the botanical source of these seeds. From the reported use of seeds of certain American species of *Strychnos* (such as, for example, *S. panamensis* and *S. tabascana*, which are used after being ground for poisoning coyotes and other animals in Mexico), it would not be surprising if some of these would prove to have strychnine and allied alkaloids in them.

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[4] In a private communication of Dec. 30, 1963 Dr. Marini-Bettolo confirmed that with the exception of samples of *root* bark of *S. guianensis,* all other samples of American species of *Strychnos* studied by him and his coworkers and referred to in various papers published up to and including 1962 were of stem bark.

Various factors influencing the alkaloid content.

There are many factors responsible for variation in the alkaloid content in individual plants of a given species. I will discuss some of these very briefly below.

a. *Genetical differences.*

From our knowledge of the active principles' content of some of the plants other than *Strychnos*, we may assume that "compact" species which are fairly uniform in their taxonomical characters and which have a restricted geographical range (such as for example, *S. bicolor* and *S. Grayi;* also probably *S. Castelnaeana*) likely will prove to be fairly uniform in their alkaloid content, as far as individual plants are concerned.

On the other hand, a very considerable variability in the alkaloid content is only to be expected in polymorphic and variable species with a very extensive range such as for example, *S. guianensis* and *S. Mitscherlichii.* We already indicated that they likely will be split into several varieties and/or forms once they are carefully studied by geneticists and ecologists. Only some of these forms likely will be found as especially rich in alkaloids. In this connection it is helpful to recall the classical finding of Prof. Reichstein who proved that sarmentogenin is found in appreciable amounts only in the seeds of a form of *Strophanthus sarmentosus* (a polymorphic and variable species) which is confined to the northern part of its very extensive geographical range.

b. *Age of plants.*

Back in the forties we studied very carefully on thousands of assays made at Merck, the distribution of the alkaloids in *Chinchona*, and the findings are very briefly as follows: only the so called amorphous alkaloids are found in the rootlets of very young plants. Perhaps they are precursors of the so-called crystallizable alkaloids in their biosynthesis by the plant. Quinine, quinidine and other alkaloids then begin to be formed in the root and stem bark and at the age of ± 4 years, *Cinchona* bark is fairly rich in crystallizable alkaloids including quinine and quinidine. They are increasing quantitatively in a rather sharp curve up to the age of about 12 years and then the alkaloid content starts very slowly to decrease.

A more of less similar situation is only to be expected in *Strychnos*, and we already have some experimental proof to this effect. I refer to the tests of total extracts of bark of comparatively young plants of *S. Castelnaeana* (*Krukoff 7538*) by Folkers and Unna in 1937 (39: 690). The alkaloid content as influenced by the age of plants, could be checked on some species of *Strychnos* by assaying the bark of young, medium age and very old plants growing in a single locality and site. As the exact age of the wild plants (not cultivated plants!) will be unknown, the results of the assays would give only indications as to just how important the age is in connection with the alkaloid content of certain species of *Strychnos*.

c. *Seasonal variations.*

Seasonal variations in the alkaloid content are of great significance in annual plants, and not of too much importance, as a rule, in perennials such as for example *Cinchona*. It is not possible to even guess at the seasonal variations in the alkaloid content in *Strychnos*. It would be extremely difficult to get these data on *Strychnos* as it is next to impossible to make such an experiment on a single plant (there would be complications, such as for example, a wound response, as the result of which there would be an increase in the alkaloid content in the bark adjacent to the wound where the previous sample was taken). For getting a clearer picture on the seasonal variation; it would be necessary to propagate a single plant of some species of *Strychnos* vegetatively, have a planting set up, and assay the bark samples taken several times a year (including those taken at the end of the rainy and of the dry seasons) of various plants of a single clone.

d. *Site.*

As far as *Cinchona* is concerned, most of the work was done by us at Merck on a single clone, which we called "ZM" and which normally contains about 6½% of quinine sulfate USPX and ± 1% of quinidine alkaloid in the bark if a given tree is grown on a "good" site. ("Site #1"). Bark of a mature tree of the same clone usually contains 1½–2% less of quinine sulfate USPX and quinidine alkaloid combined if this clone is grown on a "poor" site ("Site #3"), with poor soil deficient in nitrogen.

e. *Methods of preparation of samples.*

These are extremely important in connection with *Cinchona* bark. As an example, I may state that samples of *unground* bark dried slowly in the *shade* in a well aerated place usually contain ± 1½% more of quinine sulfate USPX and quinidine alkaloid combined than the samples of bark *ground* while green and *quickly dried* in *strong sun.*

Nothing is known of the alkaloid content of bark of *Strychnos* as influenced by the various methods of preparations of samples.

f. *Age of samples.*

Some of the chemists with whom I have had correspondence have the opinion that the bark stored over a long period is losing its activity. Their opinion is based largely on Dutcher & Wintersteiner's findings of this fact in connection with samples of *Chondodendron tomentosum* (Menispermaceae) which cannot be disputed, but in my judgment may well not apply to the bark of *Strychnos.*

There are indications that samples of stem bark of at least some of the American species of *Strychnos* dried in the sun immediately after the collection retain the alkaloids well in long storage. For details see under *S. solimoesana.*

g. *Erroneous identifications.*

Some of the conflicting results reported on the alkaloids, as well as on the curare activity of the total extracts of certain species to which I refer above, are obviously also the result of incorrect identifications of the plants on which studies were made. Folkers and Unna, also King, are the only ones who cite in their papers the collector's number of botanical specimens (vouchers) taken from the same plants as the samples for chemical studies. By checking on these (they are deposited with the herbaria at N. Y. Botanical Garden and Kew) it has been possible to ascertain the correct botanical identity of one plant studied by King (for details see under *S. guianensis,* and *S. glabra*); as well as of one plant studied by Folkers and Unna. This plant was cited by them as "*S.* sp. nov., related to *S. diaboli* Sandw." and was later identified by me as *S. javariensis.*

Chemical studies of the American species of Strychnos are very incomplete.

It is quite likely that in the majority of the American species of *Strychnos* the root bark is the preferred source of the alkaloids with curarizing activity and therefore it is obvious that until it is studied chemically (and until the seeds of the same species are also studied), no complete picture on the alkaloids in a given species could be obtained. Under the circumstances, it would appear that up to date we do not have a *complete* picture on the alkaloids in any of the American species of *Strychnos*. Some of the species which are presently reported as poor in alkaloids, on the basis of assays of bark of stems, likely will be found as rich in alkaloids when the bark of roots is studied. Even in *S. toxifera* and *S. Melinoniana*, the stem bark of which was studied extensively, some alkaloids which do not occur in the stem bark may be found in the root bark (also in the seeds).

The majority of the species, which were studied chemically, contain a very high number of different alkaloids (about 40 alkaloids in *S. solimoesana*) though the average in most of the species studied is 20–25 (109: 139).

We will now discuss species of *Strychnos* which were studied chemically.

Longiflorae.

As is evident from Appendices I and V of the 35 species known to date (and 1 variety) of *Longiflorae*, 14 species were studied. Of these, *S. toxifera* and *S. solimoesana*, which are known as the main components of curare, and also *S. trinervis* of Southern Brazil, and which of course is not used in curare, were found to be especially rich in alkaloids and their total extracts have a strong curare activity. Of the 14 species studied, *S. Jobertiana* and *S. Peckii* were found to have only traces of alkaloids, at least in the bark of stems; the alkaloids of *S. javariensis* and *S. Erichsonii* were not characterized as yet, whereas the total extracts of *S. Erichsonii* (and probably of *S. diaboli*) did not show any curare activity.

In reference to the species which were not studied chemically, I wish to make the following suggestions which are based on our botanical knowledge of the relationship of the species:

1. *S. brachiata*, and *Blackii* likely will be found as rich in the alkaloids with curare activity, as these species are related to *S. trinervis*. The same is expected from *S. medeola* which is not too far removed botanically from *S. toxifera*.
2. *S. darienensis* likely will be found as poor in the alkaloids with curare activity.
3. *S. pseudo-quina* (and possibly *S. Smithiana* which is very close botanically to *S. Erichsonii*) likely will not show any curare activity in its total extracts of bark.
4. *S. Mitscherlichii* (which has already been studied chemically on the basis of four collections) likely will be found as extremely variable in the alkaloid content.

Intermediae.

Of the nine known species of *Intermediae*, five species were studied. Of these, *S. guianensis* which is known as the main component of curare was found to be rich in alkaloids and its total extract has a strong curare activity. The results of chemical studies and pharmacological tests with *S. glabra*, another main component of curare, are confusing. (See for example the results of tests by King of the total extracts of stem bark of this species on curare activity.) This matter likely will be somewhat clarified once *authentic* samples of bark of roots as well as of bark of stems from the lower part, as well as from the upper part of plants are studied. In this connection it is also to be noted that sterile specimens of *S. pachycarpa* (*Breviflorae*), which contains only tertiary alkaloids are difficult to distinguish from those of *S. glabra*. The possibility is not excluded that some of the samples thought to be of *S. glabra* and of which the total extracts did not have any curare activity were in reality of *S. pachycarpa*.

Of the five species studied, *S. cogens* was found to have traces of alkaloids only, whereas the alkaloids of *S. Melinoniana* were found to have no curare activity.

In chemical work with species of this section, it is particularly important to use the root bark rather than the stem bark. Of the species which were not studied chemically, it seems likely that *S. bicolor* and *S. panurensis* will be of particular interest as they are related to *S. guianensis*.

Breviflorae.

Of the 20 known species of *Breviflorae*, six species were studied. Of these species total extracts of *S. acuta* showed no curare activity; whereas *S. pachycarpa* was found to contain only "tertiary bases." It is regrettable that up to date *S. Castelnaeana*, which is a well known main component of curare of the Tecunas of Brazil (this particular curare was a subject of classical studies by La Condamine in 1745), has not been studied chemically recently. No alkaloids of this species were isolated and/or characterized to date. It has been studied chemically by Folkers back in 1937, but at that time the chromatographic, electrophoretic and counter-current distribution methods were not in use as yet, and an appropriate application of these methods is usually necessary for isolation of pure alkaloids from *Strychnos* species.

In this section are included five species of *Strychnos* (*S. Fendleri*, *S. Poeppigii*, *S. tarapotensis*, *S. brasiliensis*, and *S. longisepala*) which are shrubs or small trees armed with spines and devoid of tendrils (tendrils are occasionally found on *S. longisepala*). None of these was studied chemically with the exception of *S. longisepala*, of which total extracts of stem bark were tested on frogs and mice. The results of these tests (these were not published) (41) are as follows:

Experiment	Plant	Paralyzing Activity in Frogs (per kg)		Subcutaneous Toxicity in Mice (per kg)	
		ml	g bark	ml	g bark
374	*S. longisepala*	10.0	24.0	(40.0)*	(96.0)*

* Mice injected with 1, 2, 5, 10 and 40 ml/kg lived.

Chemical studies of *S. parviflora* would be of particular interest. In our monograph we state: "*S. parviflora* is sufficiently outstanding in its anomalous position in *Breviflorae* and particularly in its unique conical stigma to merit a monotypic sectional recognition" (1: 252).

CHEMICAL STUDIES OF AFRICAN AND ASIATIC (ALSO POLYNESIAN AND AUSTRALIAN) SPECIES

Of some 100 known African species of *Strychnos*, 22 species were studied chemically mostly by Denoël and his coworkers. The alkaloids of African species of *Strychnos* are usually tertiary and have a convulsant action. The main representatives are strychnine and brucine and other tertiary alkaloids very similar to these both chemically and pharmacologically. So far the presence of quaternary alkaloids with curare activity has ben reported only for *S. angolensis.*

Of some 70 known Asiatic species (incl. Polynesian and Australian species), about 15 species were studied chemically. The majority of species contain tertiary alkaloids with strychnine-like action. The presence of curarizing alkaloids in some Malayan species is suspected but was never confirmed.

Of 64 American species known to date (and 1 variety) of *Strychnos,* 25 species were studied chemically and the presence of curarizing alkaloids was demonstrated in all but four species (*S. Erichsonii, S. Melinoniana, S. acuta* and (?) *S. diaboli*).

On the other hand, recently it has been demonstrated that no substantial differentiation can be made between *Strychnos* alkaloids of the strychnine group that were found in Asiatic and African species, and the quaternary alkaloids from American species (106: 329). It has been shown that the structure of strychnine can be related biogenetically to the quaternary alkaloids of American species through the Wieland-Gumlich aldehyde, which was found as Caracurine VII in *Strychnos toxifera.*

Diaboline previously known to occur in the bark of stems of an American species (*S. diaboli*) was recently found in fairly pure form and in excellent yields (1.5%) in fruits and leaves of an undetermined Malayan *Strychnos* (*KL 1929*) (107) and in this connection Marini-Bettolo makes an interesting observation: "The alkaloid (diaboline) common to both South America and Asiatic *Strychnos* may represent the missing link between the strychnine and curare alkaloids. For this reason, it must be assumed that henceforth all *Strychnos* alkaloids should be considered and studied as a single group." (106: 330).

PROBLEMS IN THE AMERICAN SPECIES OF STRYCHNOS

In 1948, before our seventh serial paper on *Strychnos* (6th supplement) appeared in print, we published a short paper under the above title (8) in which we discussed briefly various problems which are important to resolve for a better understanding of the group. Since then some of these problems were resolved, others remain unsolved as yet, and it is now desirable to discuss these.

As far as *Longiflorae* are concerned eight problems were discussed by us in 1948 (8).

The outstanding remaining problem is that of *S. Mitscherlichii.* Once extensive collections of flowering and particularly fruiting material (mature and carefully prepared fruits) will become available, collected from various parts of its very extensive geographical range, it is quite possible that more than two distinct entities will be recognized. Additional flowering material of *S. Mitscherlichii* var. *pubescentior* became available since 1948 and I believe that it now has a much better chance to remain at least as a good variety.

Recent collections of mature fruits of *S. Barnhartiana,* which proved to be very different from those of its closely related *S. rondeletioides* removed the last trace of doubt, and it is now clear that it is a good distinct species related to *S. rondeletioides.*

Recent collections of mature fruits of *S. macrophylla* which proved to be different from those of its closely related *S. rondeletioides* provide additional proof that it probably would be best to treat it as a distinct species. However, it is unfortunate that up to the present time it has been collected only in the basins of Rio Negro and of Rio Urubu in the vicinity of the type locality (Manaos). If its range will be found as very restricted, there will be justification to reconsider as to whether or not it is best to treat it as a variety.

The problem of *S. pubiflora* vs. *S. Gardneri*, as it stands now, is precisely like that of *S. macrophylla* vs. *S. rondeletioides*. If the range of *S. pubiflora* will be found as very restricted then there will be justification to reconsider as to whether or not it is best treated as a variety. In the original description of *S. pubiflora* we stated: ". . . inflorescences and flowers essentially as in *S. Gardneri* except that both the tube and lobes of corolla without (mostly toward apex of former and toward base of latter) are not merely densely cinereous-papillose but also pubescent with spreading pale soft hairs." Fruits of *S. pubiflora*, as per Ducke (31: 30) are smaller than those of *S. Gardneri* but only one perfect fruit of it was seen by him. It looks as though this species is confined to a special habitat.

A recent collection of flowers of *S. solimoesana* places this species together with four other species of *Longiflorae* with axillary inflorescences and pilose styles. Ducke's description of poorly preserved flowers is very incomplete and a new collection (in flower) will permit us to assign it to a precise position in the systematic arrangement of the species. I never had any doubt that it is a good distinct species of *Longiflorae*.

In 1948 we wrote: ". . . also a desideratum is a good series of flowering specimens verifying the differences advanced for separating *S. Smithiana* from *S. Erichsonii*, two species very closely allied." It is unfortunate that no progress on this has been made since 1948 and I have been unable to find in new collections a single sterile specimen which I could match well with the original four collections of *S. Smithiana* on vegetative characters.

S. tabascana differs from its very close relative, *S. panamensis*, mainly in the presence of pubescence on the outside of the corolla-tube. Originally on the basis of specimens (in flower) available, we thought that they had distinct ranges, the former being confined to the Atlantic region whereas the latter to the Pacific region of tropical Mexico and Central America, and only *S. panamensis* extending its range to Panama, northern Colombia and north-western Venezuela. Now it has become evident that their ranges overlap, at least in Costa Rica. On the other hand, indications are that it may yet be feasible to separate these two species on the basis of fruit characters. I hope to be able to check on this before long. If the ranges of *S. tabascana* and *S. panamensis* will prove to overlap in many points, then we will have to recompile their ranges on the basis of specimens in flower only (and in fruit, provided they are different). They are among a few species, of *Longiflorae* which I cannot distinguish on the basis of sterile specimens.

Since 1948 some progress has been made in tying up the Central American specimens of *S. darienensis* with the material from South America which has been referred by us to this species. Flowers of collections from Brazilian Amazonia proved to fall in well with our description of those compounded from the original description and from the dissection of flower-buds which were available to us while we were working on the monograph. Fruits described by Ducke on the basis of material from Brazilian Amazonia (31: 31) match well our description of its fruits which we made on the basis of *Tonduz 7236* collected in Costa Rica (1: 294).

In addition to the above referred to eight problems which we originally discussed in 1948, we now have new ones. Flowers are needed of *S. eugeniaefolia* to verify its position in the systematic arrangement of the species.

As far as *Intermediae* are concerned, back in 1948 we discussed at length the problem involving *S. guianensis* and *S. glabra*. Abundant collections of both of them (particularly of the former), which became available since 1948, have caused me to conclude that they are best treated as two distinct species. I also doubt now that any good varieties could be segregated but it is quite possible that some weak forms could be established with the assistance of ecologists and geneticists, once they are studied in detail in the field.

The most important taxonomical problems in *Strychnos* concern *Breviflorae*. In 1948 we wrote: ". . . the understanding of *S. rubiginosa* and its relationships to *S. parvifolia* and also the true status of the poorly collected *S. acuta* and *S. albiflora*, need a thorough field investigation. The specimens collected by Luis Emygdio de Mello Filho et al. in the basins of Rio Doce, Espirito Santo, Brazil, have demonstrated this problem in a very striking way. A field survey of *Strychnos* in the Rio Doce area should yield much in solving the problem. It is necessary that extensive collections backed by flowering material of *S. rubiginosa, S. parvifolia, S. acuta* and *S. albiflora* be made in their type localities and adjacent areas, in as many diverse habitats as possible, with a view of linking varietal forms so as to prove the precise delimitations of the species" (8: 37). No progress on this problem was made since 1948. The coastal region of southern Brazil, where these species occur, remains as one of the most poorly collected regions in Brazil. Incidently the above referred to problem likely will not be too difficult to solve once the necessary abundant new collections will become available.

It is difficult to distinguish *S. nigricans, S. mattogrossensis* and *S. Schultesiana* on vegetative characters, and the first two species also on flower characters (flowers of *S. Schultesiana* are not known). They are specifically distinct as they have very different fruits. Flowers are needed of *S. Schultesiana* and abundant collections of *S. mattogrossensis* as well as of *S. Schultesiana* in fruit for compiling their geographical ranges. It is quite likely that once the complex with large fruits and thick shells, presently treated as *S. nigricans*, is well studied in the field as well as on the basis of cultivated plants grown from seeds collected in Central America, as well as from the Amazon basin and from Southern Brazil, two or more entities will be recognized. Incidently it is doubtful that this complex has a geographical continuity of distribution.

In 1948 we stated: ". . . a long series of flowering specimens of *S. longisepala* and *S. Poeppigii* from as many localities as possible encompassing the range of the two, may eventually amass numerous transitional forms and consequently suggest a revaluation of these. There is already evidence that *S. longisepala* approaches *S. Poeppigii*. Note should also be made of *S. tarapotensis* the shortest-sepaled species in the triad, which should be considered the opposite extreme from *S. longisepala*" (8: 40). Only two new collections of *S. longisepala* were made since 1948.

Back in 1948 we discussed at length the problem involving *S. brasiliensis* (8: 36) and since then I have seen 51 new collections of this species. I now doubt that any good varieties could be recognized in this extremely variable species, but it is quite possible that some weak forms could be established with the assistance of ecologists and geneticists once they are studied well in the field as well as on the basis of cultivated plants grown from seeds collected from various parts of its range.

Mention should be made that flowers of two species (*S. eugeniaefolia* and *S. Schultesiana*) are still not known; also that we do not know as yet the fruits of eleven species (*S. colombiensis, S. asperula, S. Krukoffiana, S. xinguensis, S.*

solimoesana, *S. lobelioides*, *S. Smithiana*, *S. Duckei*, *S. Bovetiana*, *S. oiapocensis* and *S. albiflora*) and only immature fruits are known of *S. pedunculata*.

Additional collections of even the best known species will be valuable, in some respect or other, for their better understanding.

SYSTEMATIC TREATMENT

Key to the sections of *Strychnos*

1. Corolla-tube manifestly longer than calyx, about equal to or much longer than corolla-lobes; style more than thrice length of ovary; anthers glabrous or (if pilose) long and acuminate at base; if inflorescences terminal then corolla-lobes when bearded not so along an upwardly curved arc.
  2. Corolla-tube longer than corolla-lobes; filaments none or (if distinct) with anthers less than 1 mm long (acuminate at base if longer; if inflorescences axillary then leaf-blades in age frequently drying an ocher-yellow. *I. Longiflorae.*
  2. Corolla-tube about as long as corolla-lobes (longer than corolla-lobes in *S. cogens* and in some individual flowers of *S. guianensis*); filaments and anthers more than 1 mm long and anthers rounded at base; inflorescences axillary and leaf-blades not drying yellow. *II. Intermediae.*
1. Corolla-tube about equal to or shorter than calyx, manifestly shorter than corolla-lobes (longer than calyx and equal to or somewhat longer than corolla-lobes in *S. pachycarpa*); style less than thrice length of ovary; anthers rounded at base and usually more or less pilose; inflorescences terminal and the corolla-lobes within bearded along an upwardly curved arc (except *S. parviflora* which is unique in having sharply conical stigma). *III. Breviflorae.*

I. Longiflorae

(Characters shown in italics do not occur in species of other sections.)

Spineless bush-ropes with tendrils (*S. pseudo-quina* a shrub or small tree; tendrils not seen in *S. colombiensis*, *S. asperula*, *S. lobelioides* and *S. pseudo-quina* but are expected in all species except *S. pseudo-quina;* the presence of tendrils in *S. pubiflora* is accepted on the authority of Ducke, whereas in *S. eugeniaefolia*, on the authority of Froes) with variable floral and vegetative characters; inflorescences terminal or axillary; corolla *long* (see key to the sections), glabrous or with indumentum of various densities and distributions both without and within, usually papillose; corolla-tube sometimes *pubescent without* and glabrous or pubescent at throat within; anthers *sessiloid* or with filaments of various lengths, included to greatly exserted, usually less than 1 mm long and rounded at base, glabrous or (if pilose) *over 1.5 mm long and acuminate at base;* style long, glabrous or pilose *toward the middle* with ascending hairs but glabrous or nearly so at base and apex, usually papillose near apex; ovary glabrous.

Key to the species of *Strychnos* sect. *Longiflorae*

1. Flowers not known; branchlets, petioles and leaf-blades essentially glabrous, verruculosity and microscopic dots are absent from the leaves. (Brazilian Amazonia and (?) French Guiana.) 14. *S. eugeniaefolia.*
1. Flowers known; combination of characters not as in the above species.
  2. Infl. terminal; leaf-blades usually not drying yellowish.
    3. Anthers 1.75–2.75 mm long and acuminate at base; corolla-tube glabrous and not papillose without, not pilose within; corolla-lobes sparsely pilose within near sinuses; leaf-blades glabrous or very sparsely microscopically puberulent, not drying yellowish, reticulation prominulous or prominent on both surfaces; calyx-lobes more or less ovate, ciliate, otherwise glabrous.

4. Filaments not distinct; anthers over 2 mm long; corolla-tube about 1.5 cm long or longer; leaf-blades smooth or lightly tuberculate above.
  5. Style pilose; infl. sparsely puberulent. (Central America.) 1. *S. chlorantha.*
  5. Style glabrous; infl. glabrous.
    6. Pedicels very short or none; corolla-tube ± 1.5 mm in diam. (Brazilian Amazonia.) 2. *S. ramentifera.*
    6. Pedicels 2–4 mm long; corolla-tube ± 1 mm in diam. (Pacific coast of Colombia.) 3. *S. colombiensis.*
4. Filaments distinct but short; anthers about 1.75 mm long, glabrous; corolla-tube about 0.85 cm long; leaf-blades roughened with crowded elevated tubercles above; style glabrous; pedicels very short. 4. *S. asperula.*

3. Anthers less than 1.5 mm long and rounded at base; corolla-tube papillose without, pilose or very shortly so within, style glabrous.
  7. Filaments not distinct.
    8. Throat of corolla-tube glaborous or puberulent within; calyx-lobes up to about 2 mm long, glabrous within; leaf-blades not lanceolate from an ovate base.
      9. Corolla-tube glabrous and papillose without, or pubescent with soft hairs as well as papillose without (not strigose); calyx-lobes 1–1.5 mm long.
        10. Anthers less than 1 mm long; corolla-tube glabrous and papillose without; calyx-lobes about 0.75 mm long, glabrous without. 7. *S. Barnhartiana.*
        10. Anthers about 1 mm long; corolla-tube pubescent with soft hairs as well as papillose without; calyx-lobes 1–1.5 mm long, pubescent without. 6. *S. macrophylla.*
      9. Corolla-tube conspicuously strigose without; calyx-lobes 1.5–2 mm long, pubescent without.
        11. Lobes of corolla densely bearded at base within; calyx-lobes densely subsetulose without; pedicels short or none; fruits small (less than 4.0 cm in diam.), seeds few.
          12. Leaf blades with secondaries and reticulation faint, 5–15 cm long, 3–9 cm broad. 19. *S. diaboli.*
          12. Leaf blades with prominent rib-like secondaries beneath and deeply impressed reticulation above, 13–19 cm long, 5–12 cm broad. 20. *S. javariensis.*
        11. Lobes of corolla glabrous within; calyx-lobes sparsely subsetulose without; pedicels up to 3.5 mm long; fruits rather large (± 7.5 cm in diam.), seeds few (± 4). (Subandean Venezuela, Colombia, Peru and Bolivia.) 8. *S. brachiata.*
        11. Lobes of corolla puberulent within; calyx-lobes densely strigose without; pedicels about 1.0 mm long; fruits large (± 12.0 mm in diam.), seeds many (± 31). (Brazilian Amazonia.) 9. *S. Blackii.*
    8. Throat of corolla-tube pilose within, glabrous or papillose-pubescent without; anthers less than 1 mm long; calyx-lobes linear-lanceolate from a broadened base, up to 3 mm long, sparsely pubescent within; leaf-blades lanceolate from an ovate base, 3–7 cm long; pedicels up to 4 mm long. 16. *S. medeola.*
  7. Filaments distinct, either very short or long.
    13. Tube of corolla pilose at throat within, glabrous without; corolla-lobes well pilose on the whole face within as well as densely bearded at base; infl. densely fulvous-puberulent with adpressed hairs; filaments very short but distinct; calyx-lobes deltoid-ovate to ovate-lanceolate; leaf-blades often drying yellowish. (Basin of the Amazon.) 5. *S. rondeletioides.*
    13. Tube of corolla glabrous at throat within; corolla-lobes not pilose on the whole face within.
      14. Anthers on very short but distinct filaments and about 1 mm long; corolla-tube pubescent without ascending or spreading subsetulose hairs, the lobes bearded at base within; infl. and calyx without densely fulvous-strigose; calyx-lobes linear-lanceolate. (Southern and Central Brazil, Southern Bolivia.) 10. *S. trinervis.*
      14. Anthers on long filaments and less than 1 mm long.
        15. Filaments about as long as anthers.
          16. Infl. and calyx hirsute with hairs about 1 mm or more long; calyx-

lobes linear-lanceolate, up to 6 mm long; leaves hirsute; corolla-tube pilose with single indumentum without; corolla-lobes lanate at base within. 17. *S. toxifera*

16. Infl. and calyx densely pubescent with short adpressed hairs; calyx-lobes ovate to lanceolate, up to 3 mm long; leaves pubescent with short hairs; corolla-tube with double indumentum without; corolla-lobes lanate on upper portion within. 18. *S. tomentosa.*

15. Filaments much longer (twice or more) than anthers, these greatly exserted; corolla-lobes glabrous within; infl. subsetulose in streaks, puberulent, or glabrous; pedicels up to 3 mm long.

17. Leaf-blades not markedly pale beneath; infl. glabrous or with subsetulose adpressed hairs.

18. Calyx-lobes lanceolate, about 3 mm long; petioles with straight hairs and also with much shorter curved hairs.

19. Corolla glabrous without. 11. *S. panamensis.*

19. Corolla pubescent without. 12. *S. tabascana.*

18. Calyx-lobes broadly ovate, about 1 mm long, petioles minutely sparsely puberulent and sparsely ciliate near base; corolla glabrous without. 13. *S. divaricans.*

17. Leaf-blades cinereous beneath; infl. puberulent with microscopic erect hairs; calyx-lobes lanceolate, about 1–5 mm long; corolla pubescent without. 15. *S. Krukoffiana.*

2. Inf. axillary; anthers sessiloid (short filaments present in *S. Erichsonii* and *S. Froesii*).

20. Styles pilose; corolla-tube pilose without; leaf-blades with principal nerves deeply impressed above, the secondaries and tertiaries likewise impressed and forming a loose reticulation. 25. *S. solimoesana.*

20. Combination of characters not as in the above species.

21. Anthers about 1.75 mm long and acuminate at base, pilose; corolla-tube glabrous within and without, not papillose; the lobes sparsely pubescent near the sinuses within; style pilose. 21. *S. Jobertiana.*

21. Anthers short (up to 1.5 mm in *S. Peckii*) and rounded at base, glabrous; corolla-tube pilose within, papillose; the lobes moderately to densely bearded within.

22. Styles pilose.

23. Leaf-blades beneath fulvous-velutinous with dense submatted indumentum; corolla-tube subsetulose without, pilose at throat within. 22. *S. pseudo-quina.*

23. Leaf-blades glabrous or microscopically puberulent to sparsely pubescent; corolla-tube glabrous without.

24. Corolla-tube pilose at throat within; calyx-lobes ovate-lanceolate, about 1.3 mm long and short-acuminate at apex; infl. densely pubescent. 23. *S. xinguensis.*

24. Corolla-tube glabrous at throat; calyx-lobes broadly ovate, usually less than 1 mm and rounded at apex; infl. sparsely puberulent. 24. *S. amazonica.*

22. Styles glabrous.

25. Corolla-tube distinctly inflated at base, its diam. just above base twice its diam. at orifice. 27. *S. lobelioides.*

25. Corolla-tube not ventricose.

26. Leaf-blades above and beneath conspicuously pubescent and not barbate in axils of the inner principal nerves; corolla-tube pubescent without; lobes of corolla papillose within above the bearded base. 26. *S. Froesii.*

26. Leaf-blades above and beneath glabrous or puberulent.

27. Lobes of corolla pubescent within above the bearded base; corolla-tube pilose at throat within; calyx-lobes pubescent without; infl. densely puberulent.

28. Corolla-tube pubescent without; calyx-lobes broadly ovate-deltoid, about 1 mm long, glabrous within. 28. *S. Peckii.*

28. Corolla-tube glabrous without; calyx-lobes ovate-lanceolate, up to 2 mm long, well puberulent within. 29. *S. Smithiana.*
27. Lobes of corolla essentially glabrous within above the bearded base.
29. Corolla pubescent without; leaf-blades barbate in axils of the inner principal nerves.
30. Tube of corolla pilose at throat within. 32. *S. pubiflora.*
30. Tube of corolla glabrous at throat within. 34a. *S. Mitscherlichii* var. *pubescentior.*
29. Corolla glabrous without.
31. Anthers on short but distinct filaments; calyx-lobes broadly deltoid, puberulent within; corolla-tube pilose at throat within; leaf-blades not barbate beneath. 30. *S. Erichsonii.*
31. Anthers sessiloid; calyx-lobes ovate to ovate-lanceolate, glabrous within.
32. Corolla-tube glabrous at throat within.
33. Calyx-lobes about 1 mm long, unequal in length, acute to somewhat rounded at apex, glabrous or sparsely puberulent without and ciliate; shells of fruits 1–3 mm thick, seeds many. 34. *S. Mitscherlichii.*
33. Calyx-lobes about 1.5 mm long, acuminate or subacuminate at apex, well subsetulose without with short rusty hairs and ciliate; shells of fruits less than 1 mm thick, seeds few. 35. *S. darienensis.*
32. Corolla-tube pilose at throat within.
34. Leaf-blades beneath well barbate in axils of the inner principal nerves (Central and Southern Brazil). 31. *S. Gardneri.*
34. Leaf-blades beneath faintly barbate if at all (Trinidad, Venezuela, British Guiana and probably basin of the Amazon). 33. *S. pedunculata.*

1. **Strychnos chlorantha** Prog.

Guatemala: Alta Verapaz (near Chirriacté, alt. 900 m), *Standley 91896* (F). Costa Rica: Alajuela (Finca Los Ensayos, San Carlos, alt. 3,000 ft), *Humberto Barquero M. 101, 102, 102a.*

The plant is a huge bush-rope, up to 4 inches in diam. and up to 100 or more ft long. Fruits (*Humberto Barquero M. 102*) immature are about 2.3 cm in diam., shells about 6 mm thick, very hard. Shells, in proportion to the size of fruits, are thicker than those of all known American species of *Strychnos,* including shells of fruits of *S. Froesii.*

DISTRIBUTION: Since our monograph on the American species of *Strychnos* was published in 1942 no new specimens of this species were collected until recently. It was known only from the type collection in flower made in Guanacaste (Naranjo), Costa Rica and three sterile collections made in Alta Verapaz, Guatemala ("in dense wet limestone forest near Chirriacté on the Peten highway, alt. 900 meters"). In connection with my present interest in obtaining samples of root and stem bark, as well as of seeds of Central American species for chemical and pharmacological studies, this species was located recently by Sr. Barquero and found to be rather common in the locality of the collection. This species doubtless occurs also in El Salvador, Honduras and Nicaragua.

Of the three known localities of the collections of this species, two localities (in Alta Verapaz, Guatemala and in Alajuela, Costa Rica, both on the Atlantic coast) are in the so-called "highlands" in Central America (elev. about 3000 ft and up) with an especially long rainy season. In spite of various inquiries, I was unable to locate "Naranjo" in Guanacaste, Costa Rica, the type locality of this species.

Of the six species of *Strychnos* which occur in Mexico and/or Central America (*S. chlorantha, S. panamensis, S. tabascana, S. Peckii, S. darienensis* and *S. nigricans*), only *S. chlorantha* and *S. tabascana* are not found in South America.

Extensive material of this species (root bark, as well as stem bark from the upper, medium and lower part of a bush-rope) was collected and sent by me recently to Prof. Paul Karrer (Zurich) for chemical studies.

2. **Strychnos ramentifera** Ducke. Fig. 3.

Brazil: Para (near Belem), *Ducke 1762, 1763.*

DISTRIBUTION: Widely distributed in the Brazilian Amazonia. In the State of Para, it has been collected near Belem, where it is fairly common, and in the basin of the middle Rio Tapajos (Cachoeira da Montanha), whereas in the State of Amazonas, in the basin of the middle Rio Jurua (munic. Eirunepé) and near the mouth of Rio Javari (Esperança). Doubtless it occurs also in adjacent Peru and Colombia.

A giant bush-rope of the high forest on terra-firme.

Mature fruits and seeds of this species are now known and were described by Ducke (31: 19, 55). They resemble (as is the case with their stems, branchlets and leaves) those of *S. Jobertiana*. Flowering specimens were collected near Belem (Para) in July; fruits, in December.

In his paper (31: 16) Ducke refers to a bark sample of this species collected by him near Belem, Para, Brazil for studies by Marini-Bettolo, Bovet and their coworkers. This sample apparently was not studied by them as yet.

3. **Strychnos colombiensis** Krukoff & Barneby, sp. nov. Fig. 4.

Ad sectionem *Longiflorae* referenda, *S. ramentiferae* affinis, sed pedicellis elongatis 2–4 mm longis (nec brevissimis vel obsoletis) statim recognita.

Folia ramorum ad anthesin lectorum iis *S. ramentiferae* similia; inflorescentiae terminales glabrae; pedicelli 2–4 mm longi; calycis segmenta 0.7–1 mm. longa ovata obtusa intus extusque glaberrima minute ciliolata; corollae tubus ±18 mm longus diametro 1 mm latus, intus extusque glaber, lobi lanceolati intus papillosi basin versus breviter barbulati extus glabri 5.5 mm longi; antherae subsessiles ±2.6 mm longae paullo (±0.5 mm) infra corollae sinus insertae, glabrae, nonnumquam in staminodia petaloidea transformatae; stylus cum ovario perglaber 18 mm longus.

Macroscopic: branches cinereous; bases of branchlets with many persistent keeled acute cataphylls; petioles 6–9 mm long; blades elliptic-obovate to elliptic-ovate 6.2–9.8 cm long, 3.2–6.4 cm broad, obtuse or subacute at base, usually abruptly short-acuminate at apex, shining on both surfaces, drying greyish green with darkened petioles, coriaceous or sub-coriaceous, 3-plinerved (the additional pair of basal-marginal nerves prominulous) with the inner pair opposite and diverging at 0–4 mm from base, reticulation prominent or prominulous on both surfaces. *Microscopic:* leaves glabrous; blades beneath with whitish atomic dots within the tissue, above usually densely and prominently tuberculate.

Inflorescences in terminal cymes, broadly corymbose and somewhat densely flowered, glabrous, bracts ovate-triangular, 0.5–1 inches long, peduncles 1.8–3.5 cm long; calyx-lobes obovate, 0.7–1 mm long, usually somewhat rounded at apex, ciliate, otherwise glabrous and epapillose; corolla-tube up to 1.8 cm long,

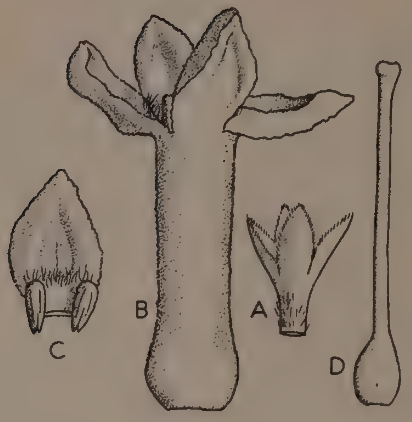

Fig. I. S. DARIENENSIS

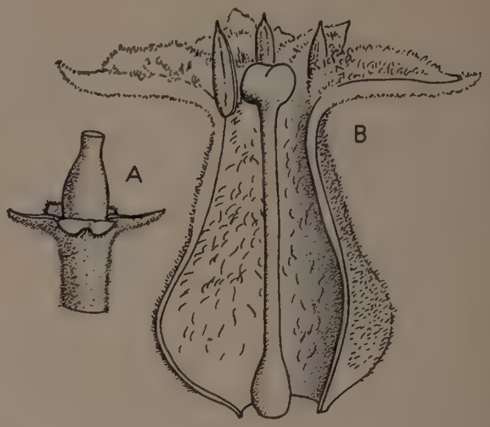

Fig. 2. S. LOBELIOIDES

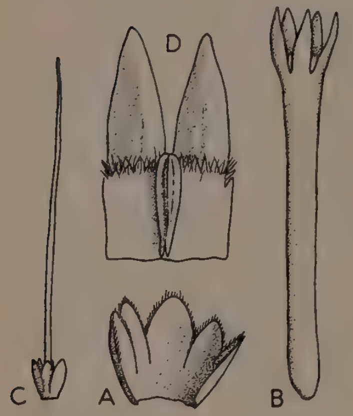

Fig. 3. S. RAMENTIFERA

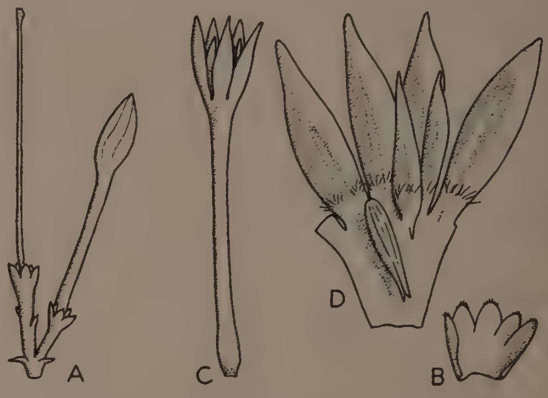

Fig. 4. S. COLOMBIENSIS

FIGS. 1–4. Fig. 1 *Strychnos darienensis*. A, calyx, B, corolla, C, interior of corolla lobes and anthers, all ×10, D, ovary and style (*Froes 21799*). Fig. 2. *Strychnos lobelioides*. A, calyx and ovary, B, corolla with part removed to show 3 stamens and the pistil, both ×10 (*Schultes & Cabrera 17295*, type). Fig. 3. *Strychnos ramentifera*. A, calyx laid open ×4, C, calyx and style, ×2, inner face of 2 petals with one anther, ×5 (*Ducke* 1763). Fig. 4. *Strychnos colombiensis*. A, flowers with bud on right, corolla removed on left to show style, ×2, B, calyx laid open, ×5, C, corolla, ×2, D, inner face of corolla-mouth showing 4 petals, 1 perfect anther, 1 staminode with anther-like tail at base; 1 staminode quite like a petal‘ but narrower, ×5 (*Cuatrecasas 14298*, type).

glabrous both without and within, epapillose; corolla-lobes about 5.5 mm long, glabrous without, papillose and glabrous within except for sparse rather short hairs along edges near sinuses; anthers irregular: 1–3 perfect, attached 0.5 mm below sinus, sessiloid, linear-oblanceolate, 2.6 mm long, projecting 0.8 mm beyond sinus; 2–3 transformed into staminodia, resembling petals but shorter and narrower; sometimes 1 (or more) intermediate in form, petaloid but with antherlike tail at base; style glabrous. Fruits not seen.

Type locality: Valle del Cauca (Costa del Pacifico, Rio Naya, abajo de Puerto Merizalde, en el brazo Aji Chiquito, orilla izquirda, alt. 1–4 m), Colombia.

Distribution: Known only from the type collection.

Colombia: Valle del Cauca, *Cuatrecasas 14298* (F, type).

S. colombiensis is closely related to *S. ramentifera* but it is immediately distinguished from the latter by its long pedicels (2–4 mm long), which are very short or none in *S. ramentifera*. In *S. colombiensis* corolla-tube is more slender; corolla-lobes are more deeply cut back, more obviously narrowed at base and pilosity is shorter and sparser; calyx is a little smaller and the ciliation of the lobes is shorter and less conspicuous. The species is easily distinguished from all other members of *Longiflorae* by its leaves (of the specimens in flowers) which however are closely resembling those of *S. ramentifera* except possibly in that they are densely and prominently tuberculate above. It is important to note that leaves of sterile collections from mature bush-ropes as well as from young plants of *S. colombiensis*, as well as its fruits, are still not known and their collection would be of considerable interest. It is quite likely that, as often is the case with the closely related species of *Longiflorae*, its fruits will be found as very different from those of *S. ramentifera*. Fruits of the latter species are very striking in appearance and are different from those of all other species of *Longiflorae*. They are up to 10 cm in diam., light greyish brown, not shining, rough, lenticellate-rugose, with thick (4–7 mm) shells. In the systematic arrangement of the species *S. colombiensis* obviously belongs with *S. ramentifera*.

The species is one of the six which are found on the Pacific coast of Colombia and one of the four which were collected in the Valle del Cauca. For details see under *S. panurensis*.

Tendrils were not seen on the specimens examined but they are expected to occur. Flowers were collected in the type locality in March.

4. **Strychnos asperula** Sprague & Sandw.

Distribution: This species is known only from two collections in flower, one from the basin of the upper Rio Purus (Rio Acre), in the Territory of Acre and the other from the basin of the middle Rio Jurua (munic. Eirunepé), in the State of Amazonas, Brazil. These collections are probably from its northern range. The species doubtless occurs also in Peru and Bolivia in the region adjacent to the Territory of Acre.

Bush-rope of the high forest on terra-firme and restinga alta.

Fruits of this species are still unknown and we also have not seen tendrils on the specimens examined. The collections of fruits and of carefully selected series of mature leaves from various parts of mature bush-ropes (also of young plants) are badly needed. Without these, this species remains a perennial headache when a large number of sterile specimens from the Amazon basin are at hand for identification. Leaves of specimens in flower usually are not of much help in the identification of sterile specimens with mature leaves. Ducke is correct in saying (31: 12) that we overlooked the importance of fruit characters in delineating the species, for the reason that they were very scarcely represented in the collections available to us for examination. On the other hand, I am convinced that Ducke never mastered the identification of many Amazonian species from sterile material for the reason that although he had an excellent opportunity to collect a series of sheets from various parts of mature and young plants, he never made an attempt to undertake such a collection, and he was very consistent in spending all his efforts in the search of flowering and fruiting material and in limiting his collections to a few branchlets in flower and in fruit.

Such collections are needed for *S. colombiensis, S. asperula, S. macrophylla, S. Blackii, S. divaricans, S. Krukoffiana, S. xinguensis* and *S. lobelioides* of *Longiflorae; S. glabra* and *S. Duckei* of *Intermediae* and *S. Bovetiana, S. rubiginosa, S. acuta, S. albiflora, S. pachycarpa, S. Schultesiana* and *S. malacosperma* of *Breviflorae.*

In his paper (31: 58) Ducke states: ". . . sterile samples, chiefly of young plants, are often misidentified and should not be included in the herbaria; their leaves frequently are very different from those from adult, fertile plants." It is incredible that such a suggestion comes from a "field-botanist." If this suggestion would be accepted, then only specimens in flower (and specimens in fruit of some of the species) would be identified, and we would not make much progress on the genus. It would have been better if Ducke had paid more attention to N. Y. Sandwith who did a remarkable job in the interpretation of certain species on sterile material and from whom we learned so much on the importance of vegetative characters in species of *Strychnos.*

5. **Strychnos rondeletioides** Spruce

Colombia: Vaupés, *P. Allen 3341* (US), *3370* (M); *Fernandez 2297* (US); *Schultes & Cabrera 13161* (US), *19197a* (US). Venezuela: Amazonas (Rio Sipapo), *Silverio Level s.n.* Peru: Loreto (near Iquitos), *Ducke 1772.* Brazil: Para: basin of Rio Tocantins (Rio Itacaiuna), *Froes & Black 24624.* Amazonas: basin of Rio Negro, *Froes 22557, 23564* (Rio Padauiry); *Black 48–2635* (Rio Içana); *Ducke s.n.* (*H. J. B. R. 23973* (US) (Rio Vaupes); basin of Rio Urubú, *Froes 25425;* basin of Rio Solimoes, *Froes 23840.*

This is the first record of the species from the State of Para. *Schultes & Cabrera 19197a* is of interest as it has been collected at the elevation of 950–1000 ft (Mesa de Yambi, savannah Goo-ran-hoo-da, on Rio Karuru). P. Allen states on the label (*P. Allen 3341*): "fruits yellow with sweet pulp, often eaten by the local Indians."

DISTRIBUTION: Very widely distributed in the Amazon basin, in Brazil as well as in Venezuela (Amazonas), Colombia (Vaupés and Amazonas), Peru (Loreto) and Bolivia (basin of Rio Mapiri, La Paz). In Brazil it has been collected in the State of Amazonas (in the basins of Rio Maués, of the upper and lower Rio Negro (where it is very common), of Rio Jutai, of Rio Tonantins, of the middle Rio Jurua and of the upper Rio Solimoes) and in the State of Para [in the basin of Rio Tocantins and on the authority of Ducke (33: 78) on a plateau between the Rivers Xingu and Tapajos]. It has not been collected as yet in the Territory of Rio Branco and in the Territory of Acre where it doubtless occurs. Outside of the basin of the Amazon, it has been collected in the basins of Rio Orinoco (State of Bolivar, Venezuela) and of Rio Oiapoque (Territory of Amapa, Brazil), on the authority of Ducke. Doubtless occurs also in French Guiana.

Mature fruits of this species are now known and were described by Ducke (31: 19, 57). In his key made on the basis of fruit characters, it comes together with *S. medeola, S. pseudo-quina, S. Gardneri, S. pubiflora* and *S. darienensis* of *Longiflorae, S. guianensis, S. glabra, S. subcordata, S. bicolor, S. panurensis, S. hirsuta, S. cogens* and *S. Melinoniana* of *Intermediae* and *S. Castelnaeana, S. rubiginosa, S. Torresiana* and *S. acuta* of *Breviflorae.* It is important to recall that its fruits are very different from those of *S. macrophylla* and *S. Barnhartiana* to which it is closely related. For more details on this, see under the two above referred to species.

The collector's note on *Steyermark 60441* (from Bolivar, Venezuela) reads: "roots used for arrow-poison; boil all day for juice to get thick" (5: 6). The collector's note on *Silverio Level s.n.* (from Rio Sipapo, Amazonas, Venezuela) reads: "voucher material for curare obtained on Rio Sipapo by Silverio Level in 1954/5. This is said to be in part, source material." The collector's note on *P. Allen 3341* (from Vaupés, vicinity of Mitu) reads: "bark of roots reported to be used in preparation of curare."

6. **Strychnos macrophylla** Barb. Rodr. Vellosia, ed. 2, **1**:33. pl. 2, f. A. 1891.

Brazil: Amazonas: basin of Rio Negro (near Manaos), Ducke *754, 1895;* basin of Rio Urubu, *Froes 25250, 25356, 25403.*

This is the first record of the species from the basin of Rio Urubú.

Distribution: This species is known from seven collections, all from the vicinity of Manaos (basin of the lower Rio Negro, Amazonas, Brazil) and from three collections from the basin of Rio Urubu, about 100 km to the northeast of Manaos.

A bush-rope of medium size confined to the primary and secondary forests on terra-firme (also in "campinaranas" and "caatingas").

In our monograph published in 1942 we placed this species with reservations in a synonymy under *S. rondeletioides,* and we reinstated it as a valid species in 1943, once the first specimen in flower became available (*Ducke s.n.* collected, on Sep. 14, 1941 near Manaos). We indicated how it differs in flower characters from *S. rondeletioides* and *S. Barnhartiana,* to which it is related (2: 21).

Mature fruits and seeds of this species are now known and were described by Ducke (31: 20, 56). They are very different from those of the two above referred to related species but are quite similar to the fruits of *S. amazonica* and *S. parviflora.*

For a better understanding of this species, we still need a series of specimens from various parts of mature and young plants so that we could distinguish it on the basis of sterile material with more confidence.

In the systematic arrangement of the species it has been placed by us next to *S. rondeletioides* (2: 21), to which it is obviously closely related, and it is not necessary to make any change.

Special comments appear to be needed in regard to Ducke collections distributed as *Ducke 1975* and *1895.*

Ducke 1975 represents two collections made from the same plant, both in flower, one made on August 26, 1946 and the other on Sept. 26, 1947. *Ducke 1895* represents three collections made from the same plant, one collected with mature fruits on April 19, 1945, another collected in flower on Sept. 23, 1945 and the other collected with immature fruits on Jan. 1, 1946. These collections are very valuable and it is only regrettable that the collections made on different dates (although from the same plants) were not distributed on separate sheets and under different collector's numbers.

According to Barbosa Rodrigues (31: 15) of all the various species of *Strychnos,* which occur near Manaos, *S. macrophylla* is the source of the best curare.

This species was studied chemically and pharmacologically by Marini-Bettolo, Bovet and their coworkers. For the alkaloid content, toxicity and curare activity of the total extracts, see (95: 1142, 1144; 108: 268). For rather extensive studies of the alkaloids of this species, see (98). In the summary the authors state: "From *S. macrophylla* a mixture of quaternary alkaloids have been obtained and separated by column chromatography. Four main alkaloids were thus obtained which have been characterized. Two of these have been identified as Mavacurine and Fluorocurine, whilst the Macrophylline A and B had not previously been described."

The above referred to work was done on stem bark collected by Ducke; one collection on Estrada de Aleixo, and another on Estrada da Bombeamento, both near Manaos, Amazonas, Brazil in April 1953 (95: 1145; 98: 338).

7. **Strychnos Barnhartiana** Krukoff

Brazil: Para (Gurupá), *Pires & Silva 4735.*

This is the first record of the species from the State of Para.

DISTRIBUTION: This species is known to date only from the Brazilian Amazonia. In the State of Amazonas, it has been collected in the basins of the upper Rio Negro, of Rio Tonantins, of Rio Iça, and of the upper Rio Solimoes, whereas in the State of Para—near Gurupá—on the Rio Amazonas proper. Doubtless occurs also in adjacent Colombia and Peru.

Mature fruits and seeds of this species are now known and were described by Ducke (31: 21, 56). They are different from those of the related *S. rondeletiodes* and *S. macrophylla,* and resemble fruits of *S. javariensis.*

8. **Strychnos brachiata** Ruiz & Pav.

Brazil: Para (boca do Rio Juruena, front. Amazonas, Para, and Matto Grosso, terra-firme) ? *Pires 3698* (NY, US).

DISTRIBUTION: This species is known to date only from ten collections, but it is amply evident that it has a very extensive range and probably is one of the commonest species of *Strychnos* in sub-Andean Venezuela, Colombia, Peru and Bolivia. Doubtless occurs also in Ecuador. How far it extends in the lowlands in the basin of the Amazon (also of the Orinoco) to the east is not yet known.

Specimens from Bolivia (basins of Rio Bopi and Mapiri) are from the elevations of 490 to 1,000 meters.

Back in 1947 we examined a puzzling sterile specimen (*Froes 21765*) from the middle Rio Jurua, and we stated (6: 9) that it resembles *S. brachiata,* but we cannot name it with any certainty. I now have examined another sterile specimen (*Pires 3698*) which matches the Froes' specimen well. The recollection of this plant in flower and its comparison with *S. brachiata* would be of considerable interest.

On the basis of our description of fruits, I am placing this species in Ducke's key made on the basis of fruit characters, together with eight other species of *Longiflorae.* For details see under *S. Blackii.*

Roots (probably bark of roots) are used on the Rio San Miguel (or Sucumbios), Putumayo, Colombia by Kofán Indians in the preparation of curare (*Schultes 3602*) (6: 10).

9. **Strychnos Blackii** Ducke, Bol. Técn. Inst. Agron. Norte **19**: 22. 1950.

ILLUSTRATION: Bol. Técn. Agron. Norte 19: pl. 8, fig. A-D. 1950.

Brazil: Para: basin of Rio Amazonas (Furos de Breves, Rio Tajapurú, Igarapé Pixuna, perto do lugar Antonio Lemos), *Black 48–2935* (July 17, 1948) (type coll.) *48–2948* (July 19, 1948); *Ducke s.n.* (*H. J. B. R. 22364*) (Sept. 25, 1926), *Froes 31953* (June 3, 1953) (cabeceira do Rio Uruará, munic. Prainha, flanco do planalto, terra-firme).

I have not seen Froes' and Black's collections of this species from the Territory of Amapa (Rio Macacoari, near Macapá); Froes' collection from the State of Amazonas (mouth of Rio Solimoes, near Manaos, Fazenda Santo Antonio) and Froes' collection from a plateau between the rivers Xingu and Tapajos to which Ducke refers in his papers (31: 28; 33: 78).

The first collection of this species (leaves and old inflorescences) made by Ducke on Sep. 25, 1926 was sent to us for identification and I wrote to Ducke on Jan. 22, 1947 that it was probably of a new species, related to *S. brachiata*, which however we do not like to describe in the absence of flowers. This specimen (*Ducke, s.n.; H.J.B.R. 22364*) is deposited at The New York Botanical Garden with our annotation label reading: "*Strychnos sp. nov.* (?) *aff. S. brachiata* Ruiz and Pav. One frag. flower seen too poor for conclusive decision." In July 1948 at Ducke's request, Black was sent to the place where the above referred to specimen was collected (Ducke's letter to me of Oct. 3, 1948) and he obtained a flowering specimen, (*Black 48–2935*). Ducke described this as a new species.

A huge bush-rope provided with tendrils which abounds on varzea and on terra-firme.

In the flower characters this species is very close to *S. brachiata*. However, flowers of *S. brachiata* were described by us in the monograph on the very old collections of Ruiz & Pavon and new collections may yet permit us to separate it from *S. Blackii* on some characters of diagnostic value. As per Ruiz & Pavon, fruits of *S. brachiata* are ±7.5 cm in diam. and with a few seeds (about 4) (1: 269), whereas, as per Ducke, a single perfect fruit of *S. Blackii* seen by him is 14.0 cm in diam. and with many seeds (31) (l.c.). The former species is known from sub-Andean Venezuela, Colombia, Peru and Bolivia, whereas the latter, from Amazonian Brazil. In the systematic arrangement of the species, I am placing it next to *S. brachiata* where it obviously belongs.

Its fruits are known and were described by Ducke (31: 21, 55). In his key made on the basis of fruit characters, it comes together with eight other species of *Longiflorae* (*S. eugeniaefolia, S. trinervis, S. divaricans, S. toxifera*, and *S. tomentosa*, also *S. brachiata, S. panamensis* and *S. tabascana*).

It would be important to collect a series of specimens from various parts of mature and young plants so that we could distinguish it on the basis of sterile material with more confidence.

10. **Strychnos trinervis** (Vell.) Mart.

ILLUSTRATION: Bol. Museu Nac. (nova serie), Rio de Jan. 13: fig. f, g (not fig. a–e, which are of *S. Torresiana*) 1951.

Brazil: Minas Gerais, *Mendes Magalhães 18915*. São Paulo *Ducke 2330*. Santa Catarina: *Reitz 1841* (US); *Reitz & Klein 3488, 3969, 7080* (US), *7374* (US); *L. B. Smith, Klein & Gevieski 7616*. Bolivia: Santa Cruz (cerro de Amboró, Sara, alt. 1000 m), *Steinbach 3009* (*Herb. Inst. Mig. Lillo 58872*) (GH).

This is the first record of the species from Bolivia.

DISTRIBUTION: Brazil (Paraiba, Pernambuco, Bahia, Espirito Santo, Minas Gerais, Rio de Janeiro, São Paulo, Parana and Santa Catarina) and Bolivia (Santa Cruz). Doubtless occurs also in the State of Alagoas, Sergipe, Goias and Matto Grosso in Brazil.

Of the South Brazilian species, according to Ducke, this bush-rope attains the largest dimensions (up to 3.5 inches in diam.) (31: 11).

Mature fruits and seeds of this species are now known and were described by Ducke (31: 22, 55). In this description he corrected two previous errors which he made in connection with the description of fruits of this species and of *S. Torresiana*. For information on its position in Ducke's key made on the basis of fruit characters, see under *S. Blackii*.

In our paper (4:343) we cite 12 specimens of *S. trinervis*, from Espirito Santo under provisional collectors' numbers (*"OVB-3"*, etc.). In their paper (35: 9), Luiz Emygdio de Millo Filho and João de Souza Campos (two of the collectors) have given also the numbers of these specimens under which they are deposited with Museu Nacional do Rio de Janeiro, and on a map facing page 16, they also indicated the precise localities of collection of these twelve specimens. The same two persons have tested the crude extracts of six species of *Strychnos*, which occur in the State of Rio de Janeiro, on the curare-like action and they give the following information on their tests (36: 8): "Das *Strychnos*, a *S. trinervis* mostra a maior atividade curarizante dentre as que foram estudadas, reunindo seus extratos as propiedades de intensidade e ação tipica. Verificaram os autores diferenças na atividade da *S. trinervis*, que se revelou mais ativa quando colhida na mata do que na capoeira. As amostras mais ativas foram colecionadas pelos autores nas matas da Gavea. Das outras espécies *S. Gardneri*, *S. parvifolia*, *S. rubiginosa*, *S. brasiliensis* e possivelmente *S. albiflora* possuem reduzida atividade." It is to be noted that the botanical identity of plants cited by the experimenters on the basis of our identifications as *S. rubiginosa* and *S. albiflora*, is still in doubt (see under these two species). No details of these tests, including the part of plant from which the extracts were prepared, the test-animal, etc., are given.

This species was studied chemically and pharmacologically by Marini-Bettolo, Bovet and their coworkers. For the alkaloid content, toxicity and curare activity of the total extracts, see (94: 856; also 95: 1142, 1144). For rather extensive studies of the alkaloids of this species, see (94). In the summary the authors state: "Chromatographic study of the alkaloids of *S. trinervis* made it possible to establish the presence of 23 alkaloids and to identify the C-calebassine (= Toxiferine II = C-strychnotoxine I), C-curarine (= C-curarine I), C-fluorocurarine (= C-curarine III) and C-fluorocurinine, the H and K (= C-dihydrotoxiferine) alkaloids of the toxipherine group and the J alkaloid. The last three of these have not hitherto been discovered in plants."

In a later paper (108: 268) Marini-Bettolo lists the following alkaloids of *S. trinervis* which were identified: "Calebassine, Curarine, alkaloids H, I, K, Fluorocurinine, Fluorocurarine."

The above referred to work was done on stem bark collected by Ducke near Recife, Pernambuco, Brazil, in July 1952 as well as on the material collected by L. E. de Mello Filho near Grajau, Rio de Janeiro, Brazil in Sept. 1953 (94: 862; 95: 1145).

Marini-Bettolo refers to tests presumably of crude extracts of this species [Brazil, Campos and Kuhlman, O. Hosp. (Rio de Janeiro), 21, 55 (1942)], but I have not seen this reference.

In the 19th century, (largely in the eighties), at the peak of interest in curare in Europe, Jobert, Couty and de Lacerda, also Schwacke, experimented with crude extracts of certain species of *Strychnos*.

Jobert experimented with extracts of *S. trinervis* (= *S. triplinervia*), *S.*

Gardneri and *S. rubiginosa,* also with extracts of *S. hirsuta* and *S. nigricans* and found these with curare activity (112; 113). For various reasons, I consider his identification of the last two species as doubtful.

Couty and de Lacerda described tests of extracts of *S. trinervis* (= *S. triplinervia*) and *S. Gardneri* on animals and found these with curare activity (114–117).

Schwacke experimented with extracts of *S. Castelnaeana* and *S. hirsuta* (118), but for various reasons I consider his identification of *S. hirsuta* as doubtful.

11. Strychnos panamensis Seem. Bot. Voy. Herald 166. 1854.

Strychnos hachensis Karst. Fl. Columb. **2**: 75. 1863.
Strychnos longissima Loesener, Repert. Sp. Nov. **9**: 357. 1911.
Strychnos tepicensis Standley, Contr. U. S. Nat. Herb. **23**: 1142. 1924.

It was most satisfactory to have been able to examine another sheet of the type collection of *S. hachensis* sent to me through the kindness of the Conservator of the Herbarium, Naturhistorisches Museum, Vienna. This specimen consists of leaves, flowers and seeds, all of which unquestionably belong to the earlier published *S. panamensis.* Thus, it is obvious that our disposition of the name, *S. hachensis,* proved to be correct. It is a nomen confusum and I am now placing it in the synonymy under *S. panamensis,* as its flowers (also fruits!) are described on the basis of a specimen plainly referable to this species. The spines shown on the illustrations (Karst. Fl. Colomb. **2**: pl. 138, 1863) are obviously drawn from a species of *Breviflorae* to which species the leaves of the specimen deposited at the Leningrad Herbarium belong (6: 15). Seeds on this specimen belong to *S. panamensis.*

Mexico: Nyarit: *McVaugh 19204* (Mich); Chiapas (near Acacoyagua), *Matuda 16501* (F), *17626.* Central America: *Wullschlägel 1957* (W). Guatemala: Retalhuleu, *Krukoff s.n.* (July 1963); *Suchitepequez* (Chicacao, a few km from railroad station Nahualate, alt. 500 ft), *Armando Guillen 201.* El Salvador: Ahuachapán (vicin. of Ahuachapán), *Standley* and *Padilla 2579.* Nicaragua: Jinotega: *Standley 9963* (F) (alt. 1400–1500 m), *10935* (1300–1500 m sierra east of Jinotega). Costa Rica: Puntarenas (near Palmar Norte), *P. Allen 6322* (F), *6634* (F); Limon (below Cairo, on Rio Reventazon), *Standley* and *Valerio 48454* (US). Panama: *Ivan M. Johnston 1299* (M, US) (San Jose Island, about 55 miles off Balboa), *Bouché M–12* (US) (La Campana); *s.n.* (M) Vacamonte Bay. Canal Zone: *P. Allen 4573, Stern et al. 35* (GH, M), *John D. Dwyer 1475* (M), *Duke 4220* (M), *Killip 39995* (US), *40007* (US). Colombia: Magdalena (Tomarrazon, Rio Hacha), *Karsten s.n.* [type coll. of *S. hachensis* (W)]; Antioquia: *Feddema 1845* (Mich); Santander (Rio Opon, alt. 200 m), *Romero Castaneda 4898* (US).

Local names: “Pataste de Mico,” “Pataste de Caballo” (Chiapas, Mexico).

The first record of the species from Nyarit and Chiapas, Mexico; from Magdalena and Santander, Colombia, and from Nicaragua. The collection from Nicaragua is of interest as it is from an elevation of 1300–1500 m. (*Steyermark 37412* from San Marcos, Guatemala was collected at an elevation of 1400–1700 meters.)

Distribution: Apparently confined to the Pacific coast of tropical Mexico, Guatemala, El Salvador and Nicaragua; abounds also in Costa Rica and Panama, in Northeastern Venezuela and in northern Colombia. The collections from Mexico are from Sinaloa, Nyarit, Tepic Territory, Guerrero, Oaxaca, and Chiapas; from Guatemala, from San Marcos, Quetzaltenango, Retalhuleu, Suchitepequez, Escuintla and Santa Rosa; from El Salvador, from Ahuachapán, Santa Ana and San

Salvador; from Nicaragua, from Jinotega; from Costa Rica, from Guanacaste, Puntarenas, Alajuela and Limon; from Panama, from Cocle, Chiriqui, Canal Zone and Panama; from Colombia, from Magdalena, Santander and Antioquia; from Venezuela, from Zulia. Doubtless found also in Honduras.

By far the most frequently collected species in Central America and one of the three species (the other two being *S. tabascana* and *S. nigricans*) which are found in Mexico. *S. panamensis* and *S. Peckii* are reaching elevations of 1400–1700 m in Central America, the other four species of the genus which occur in Central America seem to be confined to the lowlands. (*S. chlorantha* has been found at an elevation of 3,000 ft.)

In Ducke's key made on the basis of fruit characters, it should be placed together with eight other species of *Longiflorae*. For details see under *S. Blackii*. Fruits and seeds are very similar to those of *S. tomentosa* but the fruit pedicels are more slender, the shells are somewhat thinner, whereas the seeds are larger.

Maximino Martinez (Plantas utiles de la Flora Mexicana, p. 509. 1959) gives the following interesting information on this plant: ". . . *S. panamensis,* de Sinaloa y Nayarit a Guerrero y Oaxaca, que se usa como *S. tabascana,* para matar perros y coyotes, moliendo la semilla y mezclándola con carne." The pulp of fruits is sweet, with pleasant odor and it is often consumed by men and animals.

This species was recently located by the writer in two localities in Guatemala, in the Dept. of Retalhuleu and in the Dept. of Suchitepequez (in a patch of virgin forest). Extensive material (root bark and stem bark from the upper, medium and lower part of the bush-rope, as well as fruit shells and seeds) was collected in the second locality from a single mature vine of about 110 ft. long and 4 inches in diameter and sent for chemical studies to Prof. G. B. Marini-Bettolo (Rome). This material is backed up by herbarium specimens (*Armando Guillen 201*).

12. **Strychnos tabascana** Sprague & Sandw.

Honduras: Sta Barbara: *Molina 3756* (F); *Cortes 3652* (F), *3657* (F, GH); Atlantida: *Standley 7723* (F). Costa Rica: Guanacaste (Naranjos Agrios, 600–700 m), *Standley & Valerio 46424* (US); Alajuela: San Carlos, *Humberto Barquero M. 104, 105.*

This is the first record of the species from Sta Barbara and Cortes (Honduras) and Guanacaste (Costa Rica).

DISTRIBUTION: Mexico (Veracruz, Tabasco); British Honduras; Guatemala (Peten, Alta Verapaz, Izabal); Honduras (Sta Barbara, Cortes, Atlantida); Costa Rica (Guanacaste, San Jose, Alajuela). Doubtless found also in Nicaragua.

Extensive collections of flowering and fruiting material throughout the range of *S. panamensis* and *S. tabascana* are needed for evaluation of these two entities.

Mature fruits were described by us (1: 273) on the basis of *Steyermark 39380* (F), whereas the seeds on the basis of *Gentle 592* (F, Mich) and presently they are not available to me. On the basis of our description, I am placing this species in Ducke's key which is based on the fruit characters (31: 53–57) together with eight other species of *Longiflorae*. For details see under *S. Blackii*.

In Nueva Farmacopea Mexicana de la Soc. Farm. Mex. (6th ed., pp. 1–1184. 1952) under "Cabalonga de Tabasco" is given the following interesting information on this plant: "Mata-perros; Veneno del diablo. . . . Bosques inmediatos a San Juan Bautista (Tabasco). . . . Los principios importantes que contienen estas semillas, son la estricnina y la brucina, que existen, según el Professor Graham, en la proporción de 1.83%. . . . ("Breve estudio sobre la Cabalonga de

Tabasco," por J. Graham y Ponz. Tesis para el examen profesional de Farmacia, Mexico. 1892)."

Through the courtesy of Dr. Efren C. del Pozo (Mexico) I received a copy of a summary of a thesis of Sr. Jose Graham y Ponz published in La Farmacia (periodico de la Sociedad Farmacéutica Mexicana), Tomo III, No. 12, pp. 277–282, Junio 15 de 1894 entitled "La Cabalonga de Tabasco." The plant description leaves no doubt that the plant is *S. tabascana*. Below I will cite some of the information which is of interest:

"Del estudio hecho por este Sr. y presentado como tésis para su examen profesional, tomamos los más interesante de èl, por tratarse de una planta indigena que contiene estricnina y brucina. . . .

"La Cabalonga de Tabasco es conocida también con los nombres de Mataperros y Veneno del Diablo. Es una planta trepadora que crece con abundancia en casi todo el Estado de Tabasco y principalmente en los bosques de los cercanias de San Juan Bautista. . . .

"Esta planta que se viene usando en Tabasco hace algún tiempo para matar perros (de aqui que le dén el nombre de Mata-perros), se usa también para destruir otra clase de animales que perjudican los intereses de los hacendados. Para verificar la intoxicación, machacan las semillas y mezclan después el polvo grueso obtenido con un pedazo de carne, que se hace en seguido comer á los animales que se trata de envenenar: al cabo de media hora, cuando mucho, comienza á obrar el principio activo de la Cabalonga de Tabasco, y pocos momentos después mueren los susodichos animales en medio de terribles convulsiones tetánicas. . . ."

The author claims that from the extract of seeds, he obtained "una masa cristalina un poco colorida en la que reconocila estricnina y la brucina por sus reacciones características. . . ." (1.83% of alkaloids in the seeds).

Recently this species was located by us in Costa Rica (Finca Los Ensayos, San Carlos, Alajuela, at an elevation of about 3,000 ft., in a patch of virgin forest).

Extensive material (root bark, as well as stem bark from the upper, medium and lower parts of the bush-rope) was collected and sent for chemical studies to Prof. G. B. Marini-Bettolo (Rome). This material is backed by herbarium specimens (*Humberto Barquero M.* No. *104, 105*).

Up to date I was unable to obtain good supplies of seeds of *S. tabascana* and/or *S. chlorantha* sufficient for the chemical and pharmacological testing. The first species is rather rare in the locality where it was located by us, whereas the second species appears to be a shy fruit bearer. We have succeeded however in collecting a very substantial quantity of seeds of *S. panamensis* (presently in the hands of Prof. Marini-Bettolo). The chemical work on these seeds will be of considerable interest. If strychnine and/or brucine will be found in these seeds, then Sr Jose Graham y Ponz will have to be given credit for the isolation of these alkaloids for the first time from an American species of *Strychnos* and in fact for the first isolation of alkaloids from the *seeds* of any American species of *Strychnos*.

13. **Strychnos divaricans** Ducke

Brazil: Pernambuco (near Recife, Brejo de Macacos), *Ducke 2309*.
This is the first record of the species from the State of Pernambuco.

DISTRIBUTION: Known only from seven collections from French Guiana and Brazil. In Brazil it has been collected in Para (Jurity Velho, near the boundary line with the State of Amazonas and in the basin of Rio Guama); Maranhão (basin of the upper Rio Pindaré), and Pernambuco (near Recife). Doubtless occurs also in the Territory of Amapa and in the States of Amazonas, Piaui, Ceara, Rio Grande do Norte and Paraiba.

In the basin of Rio Amazonas it seems to abound in high forest on terra-firme, as well as on varzea.

Mature fruits and seeds of this species are now known and were described by Ducke (31: 23, 55). For information on its position in Ducke's key, made on the basis of fruit characters, see under *S. Blackii.*

For a better understanding of this species, we still need a series of specimens from various parts of mature and young plants, so that we could distinguish it on the basis of sterile material with more confidence.

This species was studied chemically and pharmacologically by Marini-Bettolo, Bovet and their coworkers. For the alkaloid content, toxicity and curare activity of the total extracts, see (94: 856; 95: 1144). For rather extensive studies of the alkaloids of this species, see (97). In these studies, 15 alkaloids were recognized by the use of chromatographic methods and the alkaloids which were characterized are as follows: Calebassine (= Toxiferine II = C-strychnotoxine I), Curarine (= C-curarine I) ; Mavacurine and Fluorocurarine (= C-curarine III) (97: 1165; 108: 268). The above referred to work was done on stem bark collected by Ducke in July 1952, near Recife, Pernambuco, Brazil (95: 1145).

14. **Strychnos eugeniaefolia** Monachino, Phytologia **4**:209. 1953.

The original description is well made and Monachino is correct that this species "is easily distinguished from all the American species described, by its small ovate leaves and the total lack of puberulence or any kind of indumentum on its branchlets, petioles and leaf-blades. Verruculosity and microscopic (atomic) dots are absent from the leaves."

It must be remembered, however, that this statement applies only to the mature leaves of the specimen in fruit of a type collection obviously obtained from the upper part of a bush-rope. Its flowers and young leaves of specimens in flower are not yet known. Once they are collected, they should be compared with those of *S. divaricans* which is known to me only from two collections in flower and five sterile specimens obviously obtained from the lower parts of bush-ropes. I have not seen as yet the collection in fruit which Ducke distributed together with *Ducke 2309* (specimens in flower) and which collection likely includes mature leaves from the upper part of a bush-rope.

Fruits and seeds of this species were described by Monachino (l.c.) and Ducke (31: 22, 55). Ducke states that fruits resemble those of *S. Blackii* but smaller (4.5–7.5 cm in diam.) with a more solid and slightly more thick (2–4 mm) shell. In his key, made on the basis of fruit characters, it comes together with eight other species of *Longiflorae*. For details see under *S. Blackii.*

TYPE LOCALITY: Territory of Amapa (basin of Rio Oiapoque, entre Igarapé Moncherri e Igarapé Nataia), Brazil.

DISTRIBUTION: As per Monachino (l.c.), in addition to the type collection (in fruit) it has been collected in the same locality for the second time by Froes and also by Black. I have not seen these two collections. The species doubtless occurs also in adjacent French Guiana.

Brazil: Territory of Amapa: basin of Rio Oiapoque (entre Igarapé Moncherri e Nataia), *Froes 25844* (type, NY).

A bush-rope of 9 cm in diam. from the high forest on low lands of terra-firme. Mature fruits were collected early in February.

Tendrils are absent on the specimens examined but they are shown on an illustration attached to the type deposited at the N.Y. Botanical Garden and which illustration, as per Monachino (l.c.), was provided by Froes.

This species doubtless is of *Longiflorae*, as suggested by Ducke (31: 22). Its fruits are large (4.5–7.5 cm in diam.), seeds are numerous and have crustaceous testa, and its inflorescences are said to be terminal (not seen by me on a single specimen examined), and the combination of these four characters places this species in *Longiflorae*.

In *Intermediae*, inflorescences are axillary, fruits of all known species are small (less than 3 cm in diam.) and seeds one (or very few) per fruit. Fruits of *S. Duckei* are not yet known. Fruits and seeds of *S. eugeniaefolia* are immediately distinguished from those of all known species of *Intermediae*. In *Breviflorae*, all known species with seeds which have crustaceous or osseous or cartilaginous testa have small fruits (less than 4 cm in diam.) whereas in *S. pachycarpa*, *S. nigricans*, *S. Schultesiana* and *S. malacosperma* which have many-seeded large fruits (4.5–10 cm in diam.) the testa is composed of wool-like fibers. Fruits of *S. Bovetiana*, *S. albiflora* and *S. oiapocensis* are not yet known. Ducke placed this species next to *S. Blackii*. However, on vegetative characters, it resembles closely *S. divaricans* and I am tentatively placing it next to this species.

Of the American species of *Strychnos*, this species and *S. Schultesiana* are the only ones of which the flowers are not yet known. Since our monograph published in 1942, flowers of *S. javariensis* and *S. solimoesana* have been collected. The collection of flowering material of *S. eugeniaefolia* would be of considerable interest.

15. Strychnos Krukoffiana Ducke, Trop. Woods **90**: 27. 1947.

ILLUSTRATION: Bol. Técn. Agron. Norte **19**: pl. 7, fig. A–D. 1950.

Brazil: Amazonas: basin of Rio Negro (near Manaos), *Ducke 1981* (Aug. 30, 1946) (*type coll.*), *s.n.* (June 6, 1945).

TYPE LOCALITY: Amazonas (basin of Rio Negro, near Manaos, north-east of Flores), Brazil.

DISTRIBUTION: Known only from two collections made from the same plant.

A giant bush-rope (provided with tendrils) from the high forest on terra-firme.

This species has been reviewed by us in detail (6: 11) and found to be related to *S. divaricans* and *S. tabascana*.

Fruits of this species are still unknown. It would be important to collect and describe mature fruits and seeds and place this species in the proper place in the key made by Ducke, which is based on the fruit characters (31: 53–57). It would also be important to collect a series of specimens from various parts of mature and young plants so that we could distinguish it on the basis of sterile material with more confidence.

The first collection of this species (leaves and old inflorescences) made by Ducke on June 6, 1945, was sent to us for identification and I wrote to Ducke that it was probably of a new species, which however we do not like to describe in the absence of flowers. This specimen (*Ducke s.n.;* June 6, 1945) with our annotation label is deposited at the N. Y. Botanical Garden. On August 30, 1946 Ducke obtained a flowering specimen from the same plant (*Ducke 1981*), and he sent this specimen to us. On Jan. 22, 1947 I wrote to Ducke (a copy of this letter is now deposited with my files at the Smithsonian Institution) concerning this specimen as follows: "I am sending you our description of a new species of *Strychnos;* which you can use if you care to in your publication. We have drawn this description along the line of our other descriptions of *Strychnos*. As I already told you, in our judgment this species is related to *S. divaricans* and *S. tabascana,* but it is easily distinguishable from these as well as others." As per Ducke (31: 23), this plant was cut down before he could collect its fruits.

In the systematic arrangement of the species, it has been placed by us next to *S. divaricans* (6: 11), to which it is related, and it is not necessary to make any change.

16. **Strychnos medeola** Sagot

Surinam: *Maguire 40811* (Cottica River, near Moengo); *Lanjouw & Lindeman 3056* (savanna, near km 116½ of railroad). Brazil: Territory of Amapa (Rio Amapari, above Serra do Navio), *Cowan 38574*. Para (planalto de Santarem), *Froes 31705*.

This is the first record of the species from the Territory of Amapa.

DISTRIBUTION: Surinam (basin of Rivers Cottica and Coppename), French Guiana and Brazil (Gurupá, Santarem, Rio Capim, the basins of the middle Rio Tocantins and of the lower Rio Trombetas, all in the State of Para, and in the basin of Rio Amapari in the Territory of Amapa). Ducke (31: 23) refers to a collection from Parintins in the State of Amazonas and another collection from the State of Maranhão (*Guimaraes & Viana*) but I have not seen these specimens.

The range of this species is rather extensive but nowhere does it appear to be common.

For information on the position of this species in Ducke's key made on the basis of fruit characters, see under *S. rondeletioides*.

17. **Strychnos toxifera** Rob. Schomb.

Venezuela: Amazonas: basin of the upper Rio Orinoco, *Baumgartner s.n.* (*Herb. Nac. Ven. 34246*) (Ven). British Guiana: Rupununi, *C. D. Cook 261*. Ecuador (upper Bobonaza, 1900 ft.) *Charles C. Fuller 67*.

LOCAL NAME: Coto iluchi (Quichua, Ecuador).

The collector's note on the above cited specimen from Ecuador reads: "whole vine crushed in curare preparation."

DISTRIBUTION: Panama (common in Canal Zone); Venezuela (on the upper Rio Orinoco, as well as at Cassiquiare and Cerro Sefato in the State of Amazonas); British Guiana; Surinam; French Guiana; Colombia (Comis. del Vichado); Ecuador (Oriente, in the basin of Rio Pastaza) and in the Brazilian Amazonia. Doubtless occurs also in adjacent Amazonian Peru and Bolivia. In Brazil it has been collected in the Territory of Rio Branco (Serra do Divisor, top of hill, 900 m); in the Territory of Acre (in the basin of the upper Rio Jurua) and in the State of Amazonas (in the basins of the middle Rio Jurua and of the upper Rio Solimoes). It is rare in Brazil which probably accounts for the fact that all its collections from Brazil were made by Froes and myself and we specifically searched for this plant.

Seven sterile specimens of young plants, five from the basin of Rio Tocantins (Para) (*Froes 23515, 23515a, 23384, 23399* and *23473*), one from the State of

Maranhão (*Froes 20342*) and one from the Territory of Rio Branco (*Froes 23110*) which were placed by us with reservations with *S. toxifera* (7: 5; 5: 7), are now placed with *S. tomentosa*. For more detailed discussion on this see under the latter species.

For information on the position of this species in Ducke's key made on the basis of fruit characters, see under *S. Blackii*.

This species is well known as the main ingredient of the curare of the Macusi and Wapisiana Indians of British Guiana; used also by the Canipusana Indians in the Cassiquiare region of Venezuela; occasionally used as a secondary ingredient by the Tecunas in Brazil; frequently used as an ingredient in curare by the Canelos in Ecuador (1: 277); used in preparation of curare on the upper Orinoco in Venezuela (5: 8) and in Comis. del Vichada in Colombia (6: 12).

Fanshawe (34: 65) gives the following information on the local names, on the field characters of this bush-rope, on its distribution in British Guiana and on its alkaloids, probably on the authority of Dr. King.

"Local names: Curare; urari (Arawak, Akawaio, Arekuna, Patamona); devil-doer, wourali.

"A canopy climber, to 2½ inches in diam.; bark dark brown, rough; slash pale crimson, soft, thick (⅛–¼ inch).

"Generally distributed throughout the colony in primary or secondary rainforest but only plentiful in a few traditionally known localities: Pomeroon River, Mount Iramaikpang, Nappi Creek (Kanuku Mountains), etc.

"The bark contains, besides other alkaloids, a quaternary alkaloid, curarine, with a paralyzing action on the peripheral nerves. As a result, voluntary muscles affecting respiration gradually cease to function and death is due to asphyxiation. It is used by the Macushi Indians in the preparation of their famous blowpipe poison."

The species was studied rather extensively and by various workers.

As per King, the alkaloid content of this species was found to be "+ + +" (74). In another paper by the same author (75) the alkaloid content is given as "+ +", curare action, "strong." All this work was done on *For. Dept. 2278* and *2285* from British Guiana and these specimens were identified by N. Y. Sandwith (his letter to me of Nov. 4, 1963). It is not known which part of the plant was used for this work, presumably stem bark. In the second paper the alkaloid content of fruits is given as "0," curare action "none." Referring to the alkaloids isolated, King states: "By chromatography of the less soluble reineckates, 12 crystalline quaternary salts, toxiferines 1–12, have been obtained, two as the chlorides and the remainder as picrates" (76).

Folkers and Unna studied this species in 1938. For the alkaloid content, toxicity and curare activity, see (39: 690, 691). This work was done on samples of stem and root bark of *Krukoff 7539* from the basin of the upper Rio Solimoes, Amazonas, Brazil, as well as on stem bark (*Martyn 9426*) and seeds and fruit shells (*Mather 9443*), both from British Guiana.

This species was studied chemically by H. Wieland and his co-workers (83) who isolated Toxiferine I, II (= Strychnotoxine II, perhaps identical with C-alkaloid A), IIa and IIb. This work was done on the bark collected on the upper Orinoco in Venezuela.

This species was also studied chemically in great detail by Karrer, Schmid and their coworkers (87) who isolated C-toxiferine I (= Toxiferine I) and certain other alkaloids from the material (? stem bark) collected on the upper Orinoco in

Venezuela. From another sample (? stem bark) collected in Venezuela the same authors isolated the following alkaloids: Caracurine I, II, III, IV, V, VI (= nor-C-alkaloid H), VII (= Wieland-Gumlich-aldehyde), VIII (isolated as chloromethylate), IX (isolated as chloromethylate); C-mavacerine; C-fluorocurine; Fedamazine and C-alkaloid Y (88). In the later paper (91) the same authors are listing the following additional alkaloids isolated from *S. toxifera:* Nor-dihydrotoxiferine, and alkaloid A8 (= N(b)-metho-Wieland-Gumlich-aldehyde).

Battersby and his coworkers (110) isolated three new alkaloids named Hemitoxiferine I, Macusine A and B together with Xanthocurine (previously known from Calabash curare).

All of the alkaloids from this species were isolated and not only demonstrated by paper chromatography.

18. **Strychnos tomentosa** Benth.

Venezuela: Aragua (La Mesa, entre 1400 m y la cumbre, valle de El Limon, Parque Nacional), *Pittier* and *Nakichenovich 15680* (Ven, US). British Guiana (Roraima), *Schomburgk 729* (W). Surinam (near km 14½ of the railroad), *Lanjouw & Lindeman 2743.* Brazil: Para: basin of Rio Tapajos, *Froes 31236, Black 47–1065;* basin of Rio Tocantins, *Froes 23510, 23515*, 23515a*, 23384*, 23399*, 23473**. Amazonas: *Froes 24050* (Lago Camatian), *Froes 23849a* (basin of Rio Jandiatuba). Territory of Rio Branco: *Froes 23110**. Maranhão: *Froes 25670, 20342**.

This is the first record of the species from Venezuela and from the State of Amazonas, Brazil.

DISTRIBUTION: Known from Venezuela, British Guiana, Surinam and Brazil where it has been collected in the State of Para (near Catú, Belem, also in the basins of Rio Tapajos and of Rio Tocantins); in the Territory of Rio Branco and in the States of Amazonas and Maranhão.

Ducke is correct in stating (31: 24) that the five sterile specimens from the basin of Rio Tocantins (cited above with an asterisk) placed by us with doubts under *S. toxifera* (7: 5), are in reality of young plants of *S. tomentosa*. Our reference to these specimens reads as follows: "The five specimens from the basin of Rio Tocantins and *Froes 23110* from the basin of Rio Branco are sterile and they are intermediate in their vegetative characters between *S. toxifera* and *S. tomentosa*. Flowers are very much desired. The specimens may well represent a form of *S. toxifera*, or be hybrids between *S. toxifera* and *S. tomentosa*." The same applies to the sterile specimen (*Froes 20342*) from the State of Maranhão.

Now that we know how the leaves look of young plants as well as of mature bush-ropes of *S. tomentosa* (not leaves of branchlets with flowers), there should be no difficulties in identifying sterile specimens of this species. Incidentally I never saw *S. tomentosa* in the wild nor had a chance to examine many sheets collected from various parts of a single mature bush-rope (also leaves of young plants). This is essential as background before sterile specimens of other collections could be identified with confidence.

The plant is a huge bush-rope. In the basin of Rio Amazonas it abounds in the high forest on terra-firme. According to Ducke its flowers are more beautiful than those of any other member of the genus, very characteristic and can measure up to 3 cm in fresh condition.

Mature fruits and seeds of this species are now known and were described by

Ducke (31: 24, 55). For information on the position of this species in Ducke's key made on the basis of fruit characters, see under *S. Blackii.*

Fanshawe (34: 65) gives the following information on the local names, on the field characters of this bush-rope and on its distribution in British Guiana:

"Local names: Devildoer; kwabanaro (Arawak); apotai (Carib).

"A canopy climber to 4 inches in diameter; bark light brown; slash pale pink, soft, thick.

"It occurs rarely in rain- and seasonal forest in the North Central and Rupununi districts and the Pakaraima Mountains."

This species was studied chemically and pharmacologically by Marini-Bettolo, Bovet and their coworkers. For the alkaloid content, toxicity and curare activity of the total extracts, see (94: 856; 95: 1144). For rather extensive studies of the alkaloids of this species, see (96). In the summary the authors state that on extracting the plant a mixture of different alkaloids was obtained and 22 alkaloids were recognized by the use of chromatographic methods. The alkaloids which were characterized are as follows: "C-alkaloid E, C-toxiferine I (= Toxiferine I), C-curarine I, C-fluorocurine, C-fluorocurinine, and C-fluorocurarine (= C-curarine III)" (93: 440, 441). The above referred to work was done on stem bark collected by Ducke near Belem, Para, Brazil in April 1952 (94: 862; 95: 1145).

19. **Strychnos diaboli** Sandw.

British Guiana: basin of Rio Mazaruni, *Forest Dept. 2297* (K).

Distribution: Well distributed in British Guiana (basins of the Essequibo, Pomeroon, Mazaruni and Demerara Rivers). Its distribution in Brazil will be discussed in the next supplement which is now in process of preparation.

This plant is of historical interest. In 1931 N. Y. Sandwith described this species as new (Kew Bull. **1931**: 486. 1931) and he also published its beautiful illustration (Hook. Ic. pl. 3173. 1932). A few years later Dr. H. King isolated a pure crystalline alkaloid, diaboline, from an authentic sample of its stem bark, the first alkaloid of the American species of *Strychnos* to be isolated and not considering the alkaloids isolated from various curares. His collaborator, pharmacologist Dr. Ranyard West, made pharmacological tests with this new crystalline alkaloid. Papers by King and West attracted considerable attention of chemists and pharmacologists, including those of Merck Research Laboratories (Drs. R. Major and H. Molitor). As a result, on June 10, 1935 I was given a commission by Merck Research Laboratories to investigate and obtain authentic materials of plants entering the curare of the Tecuna Indians of Brazil which culminated in the publishing, together with J. Monachino, of a monograph of the American Species of *Strychnos* in Sept. 1942. Ten additional short papers were published from 1943 to 1950, although for all practical purposes my work on *Strychnos* was abruptly terminated on Nov. 27 1948 with my departure for Guatemala. The intensive search for *Strychnos*, unequalled for any group of plants in the great basin of the Amazon (except for *Hevea* during the war), continued uninterruptedly from 1942 to 1960. About fifteen hundred new collections were made and they were largely collected by several persons (Froes, Ducke, Black and others), all associated with the Instituto Agronômico do Norte (Para, Brazil), by R. E. Schultes who, over a period of several years, has made rather extensive collections in the Amazonian Colombia, and by others.

Since our revision of the American species of *Strychnos* was published in 1942, two new species (*S. Duckei* in 1946 and *S. Torresiana* in 1948) were described by us; one species (*S. eugeniaefolia* in 1953) by Monachino; four species (*S. pachycarpa* in 1945; *S. Krukoffiana* in 1947; *S. Blackii* in 1950 and *S. Froesii* in 1951) by Ducke; one species (*S. oiapocensis* in 1959) by Froes; one species (*S. malacosperma* in 1955) by Ducke and Froes; one species (*S. Bovetiana* in 1960) by Pires and three new species are described in this paper.

In his paper "O gênero *Strychnos* no Brazil" (31) published in 1955, Ducke made a valuable contribution by describing mature fruits and seeds of all known Brazilian species except for *S. asperula*, *S. Krukoffiana*, *S. xinguensis*, *S. solimoesana*, *S. Smithiana*, *S. Duckei*, *S. Bovetiana*, *S. albiflora*, *S. Schultesiana*, *S. oiapocensis* and *S. pedunculata*. It is incredible but it is a fact that of the 64 species (and one variety) of known American species of *Strychnos* 50 species (and one variety) are known from collections in flower and fruit; 11 species from collections in flower only (fruits are not known of *S. colombiensis*, *S. asperula*, *S. Krukoffiana*, *S. xinguensis*, *S. solimoesana*, *S. lobelioides*, *S. Smithiana*, *S. Duckei*, *S. Bovetiana*, *S. albiflora*, and *S. oiapocensis;* only immature fruits are known of *S. pedunculata*) and two species from collections in fruit only (flowers are not known of *S. eugeniaefolia* and *S. Schultesiana*. These statistics are very different, to say the least, from the statistics of specimens available to N. Y. Sandwith in 1933 when he was engaged in the difficult pioneering task of bringing order in the species of *Strychnos* occurring in British Guiana and Trinidad.

Equally dynamic progress was made since the late thirties in the chemistry of *Strychnos* species and of various curares, largely through the efforts of King and West, of H. Wieland and his coworkers, of the Nobel Laureate Karrer, Schmid and their coworkers, of Schlittler and his coworkers, of Marini-Bettolo and his collaborator, Nobel Laureate Bovet and their coworkers, of T. Wieland and his coworkers, and Battersby and his coworkers.

Inasmuch as I have been very closely in touch with developments in the progress with American species of *Strychnos* since 1936, I believe that it is quite correct to say that it all started with N. Y. Sandwith's brief paper in which he described *S. diaboli*, and King and West's work on its bark.

Fanshawe (34: 65) gives the following information on the local names, on the field characters of this bush-rope, on its distribution in British Guiana and on its alkaloids, probably on the authority of Dr. King:

> "LOCAL NAMES: Black devildoer; kwabanaro (Arawak); urariballi (Arawak); kumarawa (Akawaio, Arekuna, Patamona, Macushi).
>
> "A canopy climber, to 6 inches in diameter; bark rough, dark reddish-brown; slash pale crimson, hard, brittle and thin.
>
> "It occurs in mora and rain-forest of all types from lateritic hill-tops to clay land in the North Central district; occasional to frequent.
>
> "It yields a weak alkaloid, diaboline, with an interesting mixture of the actions of strychnine (stimulation of the central nervous system) and curarine (depression of nerve-muscle conduction). King states that he found no curare-like action. It has a lissive action on dogs."

As per King, the alkaloid content of this species was found to be "++" (*Forest Dept. 2295*) (74). In another paper by the same author (75), the alkaloid content is given as "+ to ++," curare activity "none" (*Forest Dept. 2295, 2468* and *2473*). They are from British Guiana. It is not known which part of the plant was used for this work, presumably stem bark. In the second paper the author states: "*S. diaboli* yields a crystalline water soluble alkaloid diaboline with the formula $C_{21}H_{26}O_3N_3$."

This species was studied by Schlittler and his coworkers (85) who isolated diaboline and desacetyldiaboline from stem bark collected by Fanshawe in British Guiana.

The structure of diaboline was studied by Battersby and Hodson (111).

The work of Marini-Bettolo, Bovet and their coworkers on the samples from Brazil will be discussed in the next supplement.

Recently I received a very interesting letter from Dr. Ranyard West dated March 23, 1964 which concerns the pharmacological actions of various extracts of three species of *Strychnos* and of *Guettarda acreana*, and which I will quote below:

"When I come to go into the *Strychnos* situation I am impressed with two things. The first is the large number of alkaloids isolated from plants like *S. Melinoniana* and *S. toxifera* by the modern techniques. And the second is the real dearth of pharmacology since the '30s.

"The following plants:

S. Erichsonii,	*S. diaboli,*	*Guettarda acreana,*	*S. "2482"**
(total alkd.)	(non-quat. alkd. incl. diaboline)	(total alkd.)	(non-quat. alkd.)

were found by me to have

1. curarising
2. nicotine-like
3. central nervous excitant
4. limited "lissive" actions.

"I do not know whether the shape of your present paper allows you to mention these pharmacological actions. I mention this because I see that, for some reason or other, King did not attach the full pharmacology (as above) to his report on diaboline in 1949" (74). "Probably this was because the pharmacologists who worked with him after my time only tested for the classical paralysing ("curariform") action, in which diaboline is undoubtedly weak. But its actions considered *in toto* linked it to strychnine on the one hand and 'curarisation' on the other (see my paper of 1937)" (77) "which is just the arrangement which is set out, chemically, by Karrer and Schmid today in their scheme:

Strychnine—Wieland-Gumlich aldehyde—diaboline—toxiferine

Why I am so anxious to see the relationship of chemistry to total pharmacology made clear by exhibiting the early pharmacology is that my own hope is that it will be within this scale of linked chemistry and mixed pharmacological action that what we searched for as the lissive action of curare will eventually make itself apparent. It is for this reason also that I would wish to see as many as possible of these new alkaloids tested in these earlier ways of ours."

The lissive action of curare is well reviewed in A. R. McIntyre's book "Curare," although his reference 23 at p. 176 should be to "Curare in Man," Proc. Roy. Soc. Med. **25**, 1107–1116 where the term "lissive" was first used by Dr. West. I am in complete agreement with Dr. West that the time is now ripe to search for this activity again. Many new alkaloids were isolated in pure form from various species of the American *Strychnos* since the early '30s. Once the very interesting and elusive "lissive" action is traced to some definite pure alkaloid, then this will open a new field for further investigation.

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* "Its pharmacology I found indistinguishable from that of *S. diaboli.*"

20. Strychnos javariensis Krukoff

DISTRIBUTION: This species is known from the western part of the Amazon basin and its range probably is more or less similar to the range of *S. Castelnaeana.* In the State of Amazonas, Brazil it has been collected in the basins of the upper Rio Solimoes, of Rio Iça, of the lower Rio Javari and of the middle Rio Jurua. Found also in Colombia (Putumayo; Amazonas). Doubtless occurs in adjacent Peru.

The species was described on the basis of sterile material and we suggested its affinity to *S. diaboli* (1: 280). Flowers were described later and it is satisfying that its position in the genus and its affinity to *S. diaboli,* which we suggested, have been fully confirmed (3: 64).

Mature fruits and seeds were described by Ducke (31: 25, 56). They resemble somewhat those of *S. Barnhartiana.*

Now that *S. Froesii* is known, I agree with Ducke (31: 36) that sterile *Ducke s.n.* (Aug. 8, 1941) collected near Manaos is best placed with *S. Froesii* rather than with *S. javariensis.*

The bark of this species is used occasionally as a secondary ingredient of curare by the Javas in Peru and Brazil (1: 280). According to Schultes the roots (probably the bark of roots) are used also in Kofán curare (Rio Putumayo, Colombia) (7: 6).

This species was studied by Folkers and Unna in 1937 (39: 692, 693) who demonstrated the presence of alkaloids which cause curare-like action in frogs. This work was done on stem bark of *Krukoff 7654* collected in the basin of the lower Rio Javari, Amazonas, Brazil. The plant was referred to by them as "*Strychnos* sp. nov., related to *S. diaboli* Sandw." and I described this species as *S. javariensis* Krukoff a few years later.

21. Strychnos Jobertiana Baillon

Colombia: Amazonas (Leticia), *Ducke 1866;* Putumayo: Rio Putumayo (frontera Colombo-equatoriana, frente a Nueva Granada, alt. 390 m), *Idrobo 2627.* French Guiana (near Mecro, opposite Clevelandia), *B. Maguire, Pires & C. Maguire 47100.* Brazil: Territory of Amapa: basin of Rio Oiapoque, *Froes 25801, 25851, Black 49–8279.* Para: basin of Rio Tocantins: Rio Itacaiuna, *Froes & Black 24475.* Amazonas: basin of Rio Negro (near Manaos), *Ducke 1731, 1914;* basin of Rio Solimoes, *Froes 23918, 23953, 24042, Black 47–1258.*

This is the first record of the species from French Guiana, from the Territory of Amapa, and from the basin of Rio Tocantins, Para.

DISTRIBUTION: Venezuela (Amazonas); Colombia (Vaupés, Putumayo and Amazonas); Ecuador; Peru (Loreto); French Guiana and Brazil. In Brazil it has been collected in the Territory of Amapa, in the State of Para (basins of Rio Tapajos and Rio Tocantins); and in the State of Amazonas (basins of the upper and lower Rio Negro, of Rio Tonantins, of the middle Rio Jurua, of the lower Rio Javari and of Rio Solimoes). Doubtless occurs also in Amazonian Bolivia.

Specimens from Ecuador (*Gill 9, 19 & 74*) are from an elevation of 1000 m.

Ducke 1914 represents three collections made from the same plant: one, on July 10, 1943; another, in flower, on Aug. 7, 1945; and the third, with immature fruits, on Feb. 5, 1946.

Mature fruits of this species are now known and were described by Ducke (31: 26, 55). As is the case with stems, branchlets and leaves, the fruits resemble those of *S. ramentifera.*

On the basis of the type collection, Jobert reports *S. Jobertiana* as one of the two species of *Strychnos* used by the Cauichanás (Rio Tonantins) in Brazil in preparation of curare the other being *S. subcordata*. It is also used as a secondary ingredient, by the Javas in Brazil and Peru, and according to Gill, for the same purpose by the Canelos in Ecuador (1: 282). On the label of a specimen collected in the basin of Rio Putumayo, Putumayo, Colombia (*Idrobo 2627*) it is stated "se crée es veneno segun informa Tiburcio Payoguaje."

This species was studied by Folkers and Unna in 1937 (39: 692) who demonstrated the presence of alkaloids which cause curare-like action in frogs. This work was done on stem bark of *Krukoff 7657* collected in the basin of the upper Rio Solimoes, Amazonas, Brazil.

This species was also studied some 16 years later by Marini-Bettolo, Bovet and their coworkers. For the alkaloid content, toxicity and curare activity of the total extracts, see (95: 1142, 1144). In another paper the same authors state: "Alcaloides seulement en traces" (108: 268). The work referred to above was done on stem bark collected by Ducke north east of Flores, near Manaos, Amazonas, Brazil in April 1953 (5: 1145; 108: 268).

22. **Strychnos pseudo-quina** A. St. Hil.

Brazil: *Pohl 1133/872* (W), *Brade & Altamiro 4060* (GH). Maranhão, basin of Rio Tocantins, *Pires & Black 2475*. Goias: basin of Rio Tocantins, *Pires & Black 2523, 2525;* north-east of Anapolis, alt. 1000 m, *Cutler s.n.* (June 5, 1943) (M). Federal District: *Heringer 8906*. Minas Gerais: *Tamberlik s.n.* (W), *Macedo 1730* (M), *Dionisio Azevedo s.n.* (Oct. 1942) (US).

This is the first record of the species from the State of Maranhão.

The two specimens from Goias were collected on the border of this state with the State of Maranhão ("campo a duas léguas de Carolina"), and in the same locality as the specimen from Maranhão. The specimens from Gois represent a glabrescent form of the species (their leaves, inflorescences and corolla-tube without are glabrescent to glabrous). For a more or less similar situation in *S. panurensis* see *Wurdack & Monachino 41195*.

Distribution: This species abounds in "cerrados," "campos secos" and "chapadas" of the Brazilian highlands in the States of Matto Grosso, Goias, Maranhão, Minas Gerais and São Paulo, also in adjacent Paraguay. Its record from the State of Rio de Janeiro (*Glaziou 14094*), cited by us (3: 65) is questioned by Ducke (31: 26) and he suggests that it is probably one of the many errors on labels of Glaziou collections, the specimens being of a cultivated plant. It is not clear whether or not Ducke has tried to check on this through the record books of Glaziou collections which may be available at Rio de Janeiro Botanical Garden. For additional discussion see under *S. guianensis*.

Ducke's spelling of the name of this species as "pseudoquina" is more correct grammatically. However, I do not wish to change the name of "pseudo-quina" as assigned by the author in the original description.

For information on the position of this species in Ducke's key made on the basis of fruit characters, see under *S. rondeletioides*.

23. **Strychnos xinguensis** Krukoff

This species is known only from the type collection made in the State of Para (near Providência on the lower Rio Xingu), Brazil.

As per Ducke (31: 26), in addition to the type deposited with Museu Goeldi

(Museu Paraense) at Belem (Para), isotypes are available at Kew and Jard. Bot. of Rio de Janeiro. It looks as though this species has a limited distribution, or is rare. The personnel of the Instituto Agron. do Norte (including my former field assistant Froes, also Ducke) have been searching for species of *Strychnos* extensively from 1942 to 1960 and failed to re-collect this plant. It is true, of course, that the basins of the middle and the upper Rio Xingu and Rio Tapajos (access to which up to the present was so difficult) were not searched and it is quite possible that the type collection was made on the outskirts of its northern range, also that this species may yet prove to be rather common on the upper ranges of these two rivers.

The fruits of this species are still unknown. It would be important to collect and describe mature fruits and seeds and place this species in the proper place in the key made by Ducke, which is based on the fruit characters (31: 53–57). It would also be important to collect a series of specimens from various parts of mature and young plants so that we could distinguish it on the basis of sterile material with more confidence.

24. Strychnos amazonica Krukoff

Colombia: Putumayo (Mocoa and vicinity, alt. 1800–2400 ft.), (?) *Schultes & Cabrera 19095* (US). Brazil: Amazonas: basin of the lower Rio Negro (near Manaos), *Ducke 2007;* basin of Rio Maués, *Pires 107.*

Distribution: Brazil (basin of Rio Maués, of the lower Rio Negro, of Rio Madeira, of the middle Rio Jurua, and of the upper Rio Solimoes, all in the State of Amazonas), Peru (basin of Rio Napo) and Colombia (basin of Rio Putumayo). Common at least in the basins of Rio Maués and of the lower Rio Negro.

Mature fruits of this species are now known and were described by Ducke (31: 28, 56). In his key made on the basis of fruit characters, it comes together with *S. macrophylla* and *S. parviflora.*

This species was studied chemically and pharmacologically by Marini-Bettolo, Bovet and their coworkers. For the alkaloid content, toxicity and curare activity of the total extracts, see (95: 1142, 1144). For rather extensive studies of the alkaloids of this species, see (102). In the summary the authors state that five alkaloids were isolated from *S. amazonica,* one of which proved to be Mavacurine whereas the others ($\alpha, \gamma, \delta, \epsilon$) have not previously been described.

The above referred to work was done on the stem bark collected by Ducke, north east of Flores, near Manaos, Amazonas, Brazil in April 1953 (95: 1145; 102: 1180).

25. Strychnos solimoesana Krukoff

Brazil: Para: basin of Rio Tocantins (Remansão de Centro, Est. Fer. km 97), *Froes 23586.*

Distribution: Known to date only from the basins of the upper Rio Solimoes and Rio Tonantins in the State of Amazonas and from the basin of Rio Tocantins in the State of Para, Brazil. Specimens from the basin of the upper Rio Negro, Amazonas are placed here with reservations. Doubtless occurs also in adjacent Colombia and Peru.

This species was described in 1942 (1: 280) on the basis of excellent sterile material, consisting of many sheets collected from various parts of a mature bushrope from the basin of the upper Rio Solimoes. As this species is very distinct in its vegetative characters, we had no hesitation in placing with it various other sterile collections from the same region, as well as from the basin of Rio Tonantins (State of Amazonas). In 1950 we placed with this species, also without hesitation, a sterile specimen collected in the basin of Rio Tocantins (State of Para), *Froes 23551*. Apparently old flowers and young fruits of this collection were available to Ducke but they were not seen by us as Ducke sent us a sterile specimen of this collection. According to Ducke, the plant belongs with *Longiflorae* and has axillary inflorescences, sessile anthers, pilose styles and corolla-tube pilose externally (31: 27). Ducke suggested its affinity with *S. amazonica*. On the basis of Ducke's very incomplete description of its flowers quoted above, it is the fifth known species of *Longiflorae* with axillary inflorescences and with pilose styles. If its anthers are short (not ± 1.75 mm long and acuminate at base as in *S. Jobertiana*) then it should be placed with *S. pseudo-quina*, *S. xinguensis* and *S. amazonica*, where I am placing it tentatively in this paper.

Ducke is correct in stating that the collection of fertile material from the type locality (basin of the upper Rio Solimoes) as well as from the basin of Rio Tonantins, would be of considerable interest. As far as *S. lethalis* Barb. Rodr. is concerned, it is satisfactory that Ducke accepted our treatment of this name, as he refers to it as "the unidentifiable *lethalis* of Barb. Rodr." (31: 58).

The fruits of this species are still unknown. It would be important to collect and describe mature fruits and seeds and place this species in the proper place in the key made by Ducke, which is based on the fruit characters (31: 53–57).

Ducke (31: 15) gives an interesting account of the use of this and certain other species by the Cauichanas on the Rio Tonantins in the preparation of curare: "Os cauichanas ao meu serviço consideravam *solimoesana* como a espécie melhor para fazer o veneno; na falta desta, tambien serviria *Mitscherlichii*." For information concerning two other species used in the curare by the Cauichanas on Rio Tonantins, see under *S. Jobertiana*.

This species was studied chemically and pharmacologically by Berredo de Carneiro (78–82) who isolated two alkaloids (stricnoletaline and curaletaline). The plant was referred by him as "*S. lethalis* Barb. Rodr." The above referred to work was done on bark of stems (*Ducke s.n., Jard. Bot. Rio 22352*) collected in the basin of Rio Tonantins, Amazonas, Brazil on Nov. 27, 1927 (31: 27). Therefore the samples were about 12 years old when they were studied chemically.

This species was studied also by Marini-Bettolo, Bovet and their coworkers (99). In their summary the authors state: "Studies of the quaternary alkaloids of *S. solimoesana* carried out by means of chromatographic methods have enabled the presence of 40 alkaloids to be demonstrated. Amongst those identified are Calebassine (= toxiferine II = C-strychnotoxine I), Calebassinine, Curarine, Fluorocurinine, Fluorocurarine (= C-curarine III) and the alkaloids C, D, E, F, G. Furthermore through spectral data, R_o and chromatic reactions 14 new alkaloids were characterized and named: Premavacurine, Precurarine, Solimoesine I-III, Solimocurarine, Fluorosolimoesine I-IV, Rubrocurarine I-III." The above referred to work was done on stem bark (*Krukoff 7790*) collected in 1936 in the basin of Igarape Belem, upper Rio Solimoes, Amazonas, Brazil and cited by us in (1: 281). According to a private communication from Marini-Bettolo the chemical studies of this species were carried on from April 1955 to April 1956 and therefore is a good proof that samples of stem bark of at least some of the American species of *Strychnos* dried in the sun immediately after the collection retain the alkaloids in long storage.

26. Strychnos Froesii Ducke, Anais Acad. Bras. Cienc. **23**: 209. 1951.

There is not the slighest doubt that *S. javariensis, S. diaboli* and *S. Froesii* are distinct species. *S. javariensis* can be immediately distinguished from the two others on the striking vegetative characters (leaves resemble somewhat those of *S. Castelnaeana* of *Breviflorae*), whereas, *S. Froesii* can be immediately distinguished from the two others on the basis of its inflorescences. Its inflorescences are axillary, not terminal as in *S. javariensis* and *S. diaboli*. Nevertheless, the recently described *S. Froesii* caused considerable difficulties to Ducke and ourselves. This species was originally described on the basis of a fruiting specimen and wrongly placed in *Intermediae*, next to *S. hirsuta* which it does not resemble either in flower, fruit or vegetative characters. Its flowers were described by Ducke eight years later on the basis of *Froes 32395* who finally placed it correctly with *Longiflorae* (33: 78).

The first collection of this species (leaves of a young plant) made by Ducke on August 8, 1941, was sent to us for identification and we cited this through error under *S. javariensis* (2: 22) which it resembles in vegetative character of young plants only.

TYPE LOCALITY: Amazonas (basin of Rio Negro, on Rio Taruma, near Manaos), Brazil.

ILLUSTRATION: Anais Acad. Bras. Cienc. **23**: 211, fig. a–d. 1951.

DISTRIBUTION: Known from the basins of the lower Rio Tapajos and of the lower Rio Xingu in the State of Para, also from the basin of the lower Rio Negro (near Manaos), in the State of Amazonas, Brazil.

Brazil: Para: basin of the lower Rio Tapajos (planalto de Santarem), *Froes 31016, 31328;* basin of the lower Rio Xingu, *Froes 32169* (Rio Jaracu, munic. Porto de Moz), *32154* (lagoa de Macapichi, Porto de Moz), *32395* (en frente Souzel), Amazonas: basin of the lower Rio Negro (on Rio Taruma, near Manaos), *Ducke s.n.* (August 8, 1941), *2272* (June 1, 1950; from the same plant as the type collection), *Froes 24919* (US, type coll.), *Ducke 2320* (K).

This is a giant bush-rope provided with tendrils which abounds in high forest on terra-firme. Fruits near Manaos were collected in June, flowers in the basin of Rio Xingu in November. Fruits and seeds of this species were described by Ducke (31: 36). For information on its position in Ducke's key made on the basis of fruit characters see (33: 86).

This species was studied by Marini-Bettolo, Bovet and their coworkers. For the alkaloid content, toxicity, and curare action of the total extract, see (94: 856; 95: 1142, 1144). For rather extensive studies of the alkaloids of this species, see (96). In the summary the authors state that on extracting the plant a mixture of different alkaloids was obtained and 14 alkaloids were recognized by the use of chromatographic methods. The alkaloids which were characterized are as follows: "Alkadoids E, I, J, K (= C-dihydrotoxiferine), Toxiferine (C-toxiferine I), Fluorocurinine, Mavacurine" (108: 269). The above referred to work was done on stem bark collected by Ducke, one collection on Rio Taruma, near Manaos, Amazonas, Brazil in May 1953 and another collection also near Manaos in February 1952 (95: 1145; 108: 269).

27. Strychnos lobelioides Krukoff & Barneby, sp. nov. Fig. 2.

Ad sectionem *Longiflorae* referenda, *S. Peckii* affinis, sed corolla basi inflata distinctissima.

Ramuli cinerei; foliorum petioli ± 10 mm. longi, laminae saepissime ellipticae 11–14.5 cm. longae, 6–7.5 cm. latae, basi rotundatae vel obtusae, apice plerumque rotundatae et abrupte brevi-acuminatae, saepe utrinque concolores rarius superne nitidae inferne pallidae vel subglaucescentes, membranaceae vel chartaceae, 3(5)-plinerviae, nervis 2 interioribus suboppositis alternisve 5–7 mm. supra basin divergentibus; reticulatio utriusque faciei nunc laxa prominula nunc haud perspicua, venulis ultimis vix elevatis.

Ramuli cum petiolis dense rugoso-tuberculatis glabri; foliorum laminae superne verruculosae inferne glabrae et saepe minutim atomiferae.

Inflorescentiae axillares cymoso-glomeratae densiflorae subglobosae, dense fulvo-puberulae; pedicelli crassi, ad 1 mm. usque longi; calycis lobi stellatim patentes ovati, ± 0.7 mm. longi obtusi, extus dense puberuli, intus glabri, ciliolati; corollae tubus ventricoso-inflatus 4 mm. longus, paullo supra basin 3.2 mm. diametro, sursum angustatus ad fauces tantum 1.4 mm. latus, extus dense papillosus pilisque brevibus crassis patulis pilosulus, intus parce pilosulus, lobi lanceolati extus longe papillosi intus dense lanato-barbati ± 2.6 mm. longi; antherae sessiloideae, ad sinus affixae, fere totae exsertae, ad 1.3 mm. longae subquadruplo angustiores, connectivo minute apiculato; stylus cum ovario glaber, stigmate capitato 7 mm. lato apice transverse sulcato; fructus ignotus.

Macroscopic: branchlets cinereous; petioles ± 10 mm long; blades usually elliptic, 11–14.5 cm long, 6–7.5 cm broad, rounded to obtuse at base, usually rounded and abruptly short-acuminate at apex, usually dull on both surfaces, sometimes shining above and pale or glaucescent beneath, membranaceous to chartaceous, 3(5)-plinerved with the inner pair subopposite or alternate and diverging at 5–7 mm from base; reticulation loose and prominulous or faint on both surfaces, with the ultimate veinlets hardly raised. *Microscopic:* branchlets and petioles glabrous; petioles rugose with conspicuous dense tubercles; blades beneath often with minute dots, glabrous, above conspicuously verrucular (tubercles following nerves and veinlets as in *S. parvifolia*).

Inflorescences in axillary clustered cymes, subglobose and densely flowered, densely fulvous-puberulent with adpressed to erect hairs; pedicels stout, up to 1 mm long; calyx-lobes stellately spreading, ovate, about 0.7 mm long, obtuse, densely puberulent externally, glabrous within, ciliate; corolla-tube 0.4 cm long, ventricose-inflated and 3.2 mm in diam. just above the base, tapering upward and 1.4 mm in diam. at the throat, densely papillose without and pubescent with thick short spreading hairs (hairs becoming shorter distally and passing upward into papilli on the corrola-lobes), thinly pilosulous within upward from near the base; corolla-lobes long-papillose without, densely lanate-barbate within, up to 0.5 mm from tip, lanceolate, ±2.6 mm long; anthers sessiloid, attached at the sinus, almost wholly exserted from the corolla-tube, up to 1.3 mm long and about four times as long as broad, the connective prolonged into a minute point; style with ovary glabrous, 4 mm long, the large capitate stigma grooved across the top, 0.5 mm long, 0.7 mm in diam. Fruits not seen.

Type Locality: Vaupes (Rio Piraparaná, Caño Teemeeña, between Lat. 0°15′ S, Long. 70° 30′ W, and Lat. 0° 25′ N, Long. 70° 30′ W), Colombia.

Distribution: Known only from the type collection.

Colombia: Vaupés: basin of Rio Apaporis, *Schultes & Cabrera 17295* (US, type).

Local name: Nee-man-dá (Barasana).

According to the collectors it is a vine with fragrant, whitish-yellow flowers.

Tendrils were not seen on the type specimen but they are expected to occur. Flowers were collected in the type locality in September.

S. lobelioides is closely related to *S. Peckii* but is immediately distinguished from the latter by the extraordinary difference in the shape of its corolla-tube which is distinctly inflated at base (resembling some of the *Lobeliae*), its diameter just above the base being twice its diameter at the orifice. Anthers are almost wholly exserted from the corolla-tube and are about four times as long as broad in *S. lobelioides,* and they are included except for their tips and about three times as long as broad in *S. Peckii.* Only very young leaves (of the type specimen in flower) are known in *S. lobelioides* and they do not resemble those of any species of *Longiflorae* (only superficially they resemble somewhat those of *S. Erichsonii*). It is important to note that leaves of sterile collections from mature bush-ropes, as well as from young plants of *S. lobelioides,* as well as its fruits, are still not known and their collection would be of considerable interest. It is quite likely that, as often is the case with the closely related species of *Longiflorae,* its fruits will be found as very different from those of *S. Peckii.* Fruits of the latter species are rather striking in appearance and are different from those of other species of *Longiflorae.* They are ±6 cm. in diam., dull, rusty-brown (when dry), reticulate-marked and warty, with rather thick (3–6 mm) shell, but somewhat friable.

S. lobelioides is immediately distinguished from 13 other known species (besides *S. Peckii*) (and one variety) of *Longiflorae* with axillary inflorescences. Five of these species (for their names see the key) have pilose styles whereas six other species have corolla-tubes glabrous externally. The remaining *S. Froesii, S. pubiflora* (which is confined to Southern Brazil), and *S. Mitscherlichii* var. *pubescentior* are immediately distinguished from *S. lobelioides* by their corolla-tubes which are not ventricose, by their inflorescences and by their leaves which are brownish-rusty pubescent on both surfaces in *S. Froesii* and are conspicuously barbate in axils of the inner principal nerves in *S. pubiflora* and *S. Mitscherlichii* var. *pubescentior.* In the systematic arrangement of the species *S. lobelioides* obviously belongs with *S. Peckii.* This is the second new species described from Colombia in this paper, from where no new species were described previously. This confirms my belief that new species are only to be expected from the poorly collected Pacific coast and Amazonian Colombia. The species doubtless occurs also in adjacent Brazil and Peru.

28. **Strychnos Peckii** B. L. Robinson

British Honduras: *Gentle 3480* (Mich), *3515.* Venezuela: Miranda (Parque Nacional), *Agostini 6* (Ven). Colombia: Meta: Cordillera de Marcarena, *Idrobo & Schultes 12116;* Vaupes: *Rafael Romero C. 1264* (US): Amazonas: basin of Rio Apaporis, *Schultes 12100.* Ecuador (upper Bobonaza, 1900 ft., cult. locally), *Charles C. Fuller 129.* Brazil: Para: basin of Rio Araguaia, *Froes 29853;* basin of Rio Tapajos (foz do Rio Juruena), *Pires 3714;* near Belem, *Pires 12.* Amazonas: basin of the lower Rio Negro (Rio Jahú, Igarapé das Onças), *Ducke 402.* Maranhão (Rio Anil), *Froes 24280.*

LOCAL NAME: Jaiya huasca (Quichua, Ecuador).

This is the first record of the species from Miranda (Venezuela), from Meta (Colombia) and from the basin of Rio Araguaia in the State of Para (Brazil). *Idrobo & Schultes 12116* was collected at the slopes of Cuchillo Palmitas at an elevation of 1600 m, the highest record for the species, and the fourth highest record for the American species of *Strychnos,* one being of *S. bicolor* from the

State of Minas Gerais, Brazil from an elevation of 1800 m; another of *S. brasiliensis* from Campos do Jordão, State of São Paulo, Brazil from an elevation of 1500–1800 m, and another of *S. panamensis* from Guatemala from an elevation of 1400–1700 m.

DISTRIBUTION: This species has a very wide range. In Central America it seems to be confined to the Atlantic Coast. It has been collected in Guatemala (Izabal), in British Honduras and in Costa Rica (Limon) and it doubtless occurs in Honduras, Nicaragua and Panama. In South America it has been collected in Venezuela (Miranda, Aragua and Amazonas); Colombia (Valle del Cauca, near the Pacific coast; Meta; Vaupés; Putumayo and Amazonas); Ecuador (Oriente); Bolivia (La Paz, basin of Rio Mapiri); British and French Guianas and Brazil where it has a very extensive range. It has been collected in the State of Para (near Belem; near Bragança; near Breves; in the basin of Rio Araguaia, near the southern border of the State, and in the basin of Rio Tapajos); in the State of Amazonas (in the basins of the lower and upper Rio Negro, of the middle Rio Jurua, of Rio Jutai, of Rio Tonantins and Rio Içа); in the Territory of Rio Branco; in the Territory of Guapore (basin of Rio Guapore); in the State of Maranhão and in the State of Bahia (munic. Ilheos). It doubtless occurs also in Surinam and in Amazonian Peru. In Brazil its range doubtless will be extended to include the Territory of Amapa, and the Territory of Acre, the States of Matto Grosso and Goias as well as the States of Piaui, Ceara, Rio Grande do Norte, Paraiba, Pernambuco, Alagoas and Sergipe.

S. Peckii has the widest range of the American members of the genus except for *S. nigricans*. It is one of the six which are found on the Pacific coast of Colombia. For further details on this see under *S. panurensis*.

This species is very common in certain regions such as for example in the Dept. Izabal, Guatemala; in British Honduras; in the basins of the upper and lower Rio Negro and of Rio Solimoes in the State of Amazonas, Brazil. It is rare in the Guianas and poorly collected in the State of Para, Brazil.

For the description of its fruits see our monograph (1: 285) and Ducke's paper (31: 29, 55).

Bark of this species is used occasionally as a secondary ingredient in the curare of the Tecunas in Brazil, and according to Gill it is used also for the same purpose by the Canelos in Ecuador (1: 287). Schultes reported that its roots (probably root bark) are used in curare by the Kofán Indians in Putumayo, Colombia (6: 13). A new record is now available that it is the chief ingredient of curare as prepared by the Karapanas on Rio Kananari in the basin of Rio Apaporis, Amazonas, Colombia (*Schultes 12100*).

Fanshawe (34: 66) gives the following information on the local names, on the field characters of this bush-rope, and on its distribution in British Guiana:

"LOCAL NAMES: Devildoer; kwabanaro (Arawak); kumarawa (Akawaio, Arekuna, Patamona, Macushi).

"A canopy climber, to 8 inches in diameter; bark dimpled, blackish.

"It occurs rarely in rain-forest on heavy soils in the North Central district."

This species was studied by Folkers and Unna (39: 692) and "showed negative action for small doses of extracts of *stem bark* but a strong curare action from the extract of *root bark* was obtained." The work was done on samples obtained from a single vine (*Krukoff 7549* from the basin of the upper Rio Solimoes, Amazonas, Brazil) and probably is the first experimental proof that the root bark at least in certain species of *Strychnos* is the only one that has an appreciable quantity of the alkaloids with curare activity.

This species was also studied some 16 years later by Marini-Bettolo, Bovet and their coworkers. For the alkaloid content, toxicity and curare activity of the total extracts see (95: 1142–1144). In another paper the same authors state: "alcaloides seulement en traces" (108: 268). The above referred to work was done on stem bark collected by Ducke north east of Colonia Campos Sales, near Manaos, Amazonas, Brazil in May 1953. In his paper (31: 16) Ducke refers to another sample of this species collected by him near Belem, Para, Brazil. This sample apparently was not studied by Marini-Bettolo, Bovet and their coworkers, at least up to the present.

29. **Strychnos Smithiana** Krukoff

Since our monograph on the American species of *Strychnos* appeared in print in 1942, no new specimens of this species have been collected. It is still known only from four collections, all made in the basin of Igarape Belem (a northern tributary of the upper Rio Solimoes), in the munic. of São Paulo de Olivença, near the Brazilian-Colombian border. Doubtless it occurs also in adjacent Colombia and Peru. Its range probably is more or less similar to the range of *S. Castelnaeana.*

Fruits of this species are still unknown. It would be important to collect and describe mature fruits and seeds and place this species in the proper place in the key made by Ducke, which is based on the fruit characters (31: 53–57). Good flowering material would be welcome.

30. **Strychnos Erichsonii** Rich. Schomb.

British Guiana: *Altson 464* (K); basin of the Potaro River, *Altson 457* (K); basin of the Mazaruni River, *Forest Dept. 6392;* basin of the Essequibo River, *Maguire & Fanshawe 22929.* French Guiana (Montagne de Kau), *Cowan 38762.* Colombia: Putumayo (near border with Ecuador, in front of Nueva Granada), *Idrobo 2634;* Amazonas/Vaupés: basin of Rio Apaporis, *Garcia-Barriga 14222, 14233, 14242, Schultes & Cabrera 12644* (US), *15542* (US), *16587* (US), *16770* (US), *16883* (US), *16887* (US), *17021* (US), *17402* (US), *17050* (US); basin of Rio Miritiparana, *Schultes & Cabrera 16276* (US), *16280* (US), *16462* (US); basin of Rio Kananari, *Schultes & Cabrera 13153* (US). Brazil: Territory of Amapa: Igarage Ponta Narri, *Black 49–8477;* basin of Rio Oiapoque, *Froes 26634.* State of Para: basin of Rio Guama, *Froes 20389, 20422, Dardano & Black 48–3073, 48–3078, Pires & Silva 4591;* near Belem, *Black 49–8143, Antonio Silva 471, Milo T. da Silva 313* (US), *Froes s.n.* (*Merck 51R6370*), *27738* (US). Territory of Rio Branco: *Froes 22916.* Matto Grosso: *Moore 574.*

"LOCAL NAME: Á-da-pee (Karipako), ee-nee-má Karapaná), koo-ee-et (Maku), cuit (Macuna), limanaju (Lesana, subtribe of the Macunas), ua-oó-nee-ma-ma (Makune), yawn-yot, yow-yoo (Puinave), wau-reé-ko-a (Tanimuka), ha-raupee, ha-ra-pa (Yakuna). These Indian names are cited as they appear on the labels of specimens collected by *Schultes & Cabrera,* also of *Garcia-Barriaga* in the basin of Rio Apaporis, Amazonas/Vaupés, Colombia.

DISTRIBUTION: British Guiana (basins of the Essequibo, Pomeroon, Berbice and Mazaruni Rivers), Surinam, French Guiana, Venezuela (Bolivar, basin of the upper Rio Paragua), Brazil, Colombia (Vaupés, Amazonas and Putumayo). Doubtless occurs also in adjacent Peru. In Brazil it has been collected in the Territory of Amapa (incl. the basin of Rio Oiapoque); in the State of Para (near Belem and in the basin of Rio Guama); in the Territory of Rio Branco; in the State of Amazonas (basins of the upper Rio Negro, of Rio Tonantins, of the middle Rio Jurua and of the upper Rio Solimoes), in the State of Matto Grosso and in the State of Maranhão.

It is common in the three Guianas, in the State of Maranhão, in the basin of the upper Rio Colimoes in the State of Amazonas and in the basin of Rio Guama in the State of Para, Brazil also in the basin of Rio Apaporis, Amazonas/Vaupes, Colombia.

In Ducke's key made on the basis of fruit characters, this species comes together with *S. Mitscherlichii* (31: 56).

According to Schultes, this species is used in curare by the Kofán Indians on the Rio Putumayo in Colombia (6: 14; 7: 7)

Fanshawe (34: 66) gives the following information on the local names, on the field characters of this bush-rope, on its distribution in British Guiana and on its alkaloids, probably on the authority of Dr. King:

"Local names: Devildoer; kwabanaro (Arawak); urariballi (Arawak); oraridan (Carib); kumarawa (Akawaio, Arekuna, Patamona, Macushi).

"A canopy climber to 12 inches in diameter; bark dark, reddish-brown, rough, slash pale crimson, hard, brittle and thin as in *S. diaboli*).

"It occurs occasionally, chiefly in mora forest on mora trees in the North Central and North East districts, the Pakaraima Mountains, and the far interior.

"The total alkaloids have a convulsant, strychnine-like action; hence its use as an aphrodisiac."

As per King, the alkaloid content of this species was found to be "++++" (74). In another paper by the same author (75), the alkaloid content is given as "+++," curare action "none." The author states: "Of the other species recorded in the table, *S. Erichsonii* is very rich in alkaloids, but they seem to resinify with great ease and may need a special technique for their characterization." This work was done on *For. Dept. 2284* (from British Guiana) which we cite under *S. Erichsonii* (4: 344). It is not known which part of the plant was used for this work, presumably stem bark.

For information on the pharmacological actions of total alkaloids of this species as found by Dr. Ranyard West, see under *S. diaboli*.

31. **Strychnos Gardneri** A. DC.

Brazil: Ceara (Serra de Araripe), *Guedes 626*. Rio de Janeiro: *Luiz Emygdio de Mello Filho s.n.* (*Museu Nac. Rio 103953*) (US).

Local name: Cipo de Jacú (Ceara).

Distribution: Confined to Central Brazil. It has been collected in the following States: Ceara, Paraiba (on the authority of Ducke), Bahia, Matto Grosso (near Cuiaba), Goias, Minas Gerais, Rio de Janeiro and São Paulo. Doubtless occurs also in the States of Rio Grande do Norte, Pernambuco, Alagoas, Sergipe and Espirito Santo.

A bush-rope provided with tendrils which abounds in dry primary and secondary forests.

For information on the position of this species in Ducke's key made on the basis of fruit characters, see under *S. rondeletioides*.

For information on the tests of crude extracts of this species for curare-like action, see under *S. trinervis.*

32. Strychnos pubiflora Krukoff

This species is known to me only from the type collection made in the State of Minas Gerais (munic. Santa Luzia, Serra do Cipo), Brazil.

Ducke (31: 30) cites two specimens collected by Mendes Magalhães in the State of Minas Gerais (Serra do Cipo and Serra do Cabral, at an elevation of approximately 900 m), but these were not seen by me. Additional information on this species, as supplied by Ducke, is of considerable interest. The plant appears to be an erect shrub, becoming scandent above ("arbusto escandente"), devoid of spines and provided with tendrils (31: 11) which abounds in the "cerrados" of the lower parts of certain mountains in the State of Minas Gerais.

Fruits and seeds were described by Ducke (31: 30, 57) as very similar to those of *S. Gardneri,* but smaller. This information, unfortunately, is based on a single perfect fruit which was examined by Ducke. For information on the position of this species in Ducke's key made on the basis of fruit characters, see under *S. rondeletioides.*

33. Strychnos pedunculata (A. DC.) Benth. Jour. Linn. Soc. **1**: 105. 1856.

(?) *Lasiostoma Bredemeyeri* Schult. Mant. Syst. **3**: 64. 1827.
(?) *Rouhamon Bredemeyeri* DC. Prodr. **9**: 18. 1845.
Rouhamon pedunculatum A.DC. in DC. Prodr. **9**: 561. 1845.
Strychnos Schomburgkiana Klotzsch; Rich. Schomb. Reisen **3**: 1144, hyponym. 1848.
Strychnos trinitensis Griseb. Fl. Brit. W. Ind. 407. 1861.
(?) *Strychnos Bredemeyeri* (Schult.) Sprague & Sandw. Kew Bull. **1927**: 128. 1927.

Recently I had the privilege of examining Bredemeyer's specimen from Venezuela, sent to me through the kindness of the Conservator of the Herbarium, Naturhistorisches Museum, Vienna at which institution a set of Bredemeyer's Venezuelan collection is deposited. This specimen was located through a helpful suggestion of N. Y. Sandwith who wrote to me as follows: "If the type of *S. Bredemeyeri* exists, it may be in the Vienna Herbarium. I have never seen it. I think Bredemeyer was a gardener sent out to Venezuela by Jacquin."

This specimen is labelled: "Bredemeyer—Caracas—Jacquin," providing proof that it was collected in Caracas by Bredemeyer, as stated in the original description by Schultes. In his letter of Feb. 13, 1964 Kurt Fitz of Naturhistorisches Museum wrote me as follows: "In our herbarium we have found only one specimen of *Strychnos* collected by Bredemeyer and this one is originating from Caracas, filed under *S. pedunculata,* ex Herb. Jacquin. Could this be an isotype? The herbarium of Willdenow is kept at the Botanical Museum Berlin-Dahlem, DBR; it is not given away on loan."

The above referred to specimen (leaves and flowers past anthesis) unquestionably is conspecific with *S. pedunculata,* and quite likely it is an isotype of *S. Bredemeyeri.* This has to be confirmed by examination of Bredemeyer's specimen at the Herbarium of Willdenow (if such still exists). Schultes' description however may be regarded as nomen subnudum by some of the taxonomists. In addition to this it is likely that an error was made by Schultes in the original description. He describes corolla as "glabrous at throat" whereas corolla-tube in the species is pilose within from near base up to throat. It is noteworthy that the above quotation is the only diagnostic words of Schultes' description of the species.

In our monograph (1: 321) *S. Bredemeyeri* was treated among doubtful species and I am now transferring it with doubts to the synonymy of *S. pedunculata.*

Venezuela: Federal District: *Bredemeyer s.n.* (Hb. Jacq.) (W) (? isotype of *S. Bredemeyeri*); *Steyermark 92087* (Ven) (laderas pendientes del lado del mar que miran hacia el Norte, arriba del pueblo de Naiguatá; bosque humedo denso, lomas de Las Delicias, entre Quebrada de Basenilla y Quebrada Guayoyo, 9–12 kms. suroeste de Hac. Cocuizal). Bolivar: *Steyermark 75559* (Ven) (Chimanthá Massif, near Rio Tirica, alt. 1000 m), *Cardona 1228* (Ven) (Rio Carum, affl. del Paragua, 350 m).

"LOCAL NAMES: Uraichá (Arekuna Indians, Rio Carum, Venezuela).

DISTRIBUTION: The species is known to me from one collection from the Island of Trinidad, four collections from Venezuela (Federal District and Bolivar), five collections from the southern part of British Guiana and one collection from the Territory of Rio Branco (Rio Cotingo), Brazil. Its range doubtless will be extended considerably by new collections. It likely will be found in patches of forests in savannas in Brazilian Amazonia. It will be recalled that *S. Melinoniana,* known previously only from the three Guianas, was found later to occur in the basin of the middle Rio Tocantins in the State of Para (*Froes 23397*).

It is satisfactory that the type locality of *S. trinitensis* has now been ascertained. I refer to the letter of Sandwith quoted by Ducke (31: 30) and which reads: "The type locality for *S. trinitensis* Griseb. is in Trinidad all right, where there is a very well-known Caura River." Thus the previous suggestion of Ducke (3: 66) that the type locality of *S. trinitensis* is on the Rio Caura, in Bolivar, Venezuela, proved to be erroneous.

Only immature fruits of this species are known. It would be important to collect and describe mature fruits and seeds and place this species in the proper place in the key made by Ducke which is based on the fruit characters (31: 53–57).

Richard Schomburgk mentions this species as providing, under the name "Yakki," an ingredient of the curare of the Makusi Indians of British Guiana (1: 291).

Fanshawe (34: 66) gives the following information on the local names, on the field characters of this bush-rope, on its distribution in British Guiana and on its alkaloids, probably on the authority of Dr. King:

"LOCAL NAMES: Devildoer; kwabanaro (Arawak); humarawa (Akawaio, Arekuna, Patamona, Macushi).

"A canopy climber, 1–2 inches in diameter.

"It occurs occasionally in seasonal forest on hillocks in the Rupununi savannas or along the foothills of the Kanuku and Pakaraima Mountains, or in the rainforest on the Kanuku Mountains.

"It contains alkaloids with a curare-like action, i.e., producing paralysis of the peripheral nerves. It is used by the Arekuna Indians to prepare a blowpipe poison."

34. **Strychnos Mitscherlichii** Rich. Schomb.

Strychnos tenuiflora Froes, in Curare and Curare-like agents, edited by D. Bovet, F. Bovet-Nitti and G. B. Marini-Bettolo, p. 85, nomen nudum. 1959.

Strychnos tenuiflora Ducke, in Curare and Curare-like agents, edited by D. Bovet, F. Bovet-Nitti and G. B. Marini-Bettolo, pp. 90, 110, nomen nudum. 1959.

I am placing with this species *Froes 31270* which is the basis for a nomen nudum cited above and which appeared in print under two different authors' names in a single paper by Froes.

Venezuela: Bolivar: *Steyermark 75558* (Chimanthá Massif, vic. of base camp, alt. 1000 m), *88127* (Ven) (Rio Toro), *Steyermark* and *G. C. K. & E. Dunsterville 93032* (south of El Dorado, alt. 1030 m), *Bernardi 1615* (Rio Tirica, alt. 500–550 ft.), *B. Maguire, Steyermark & C. Maguire 46758* (Ven) (the upper Rio Cuyuni). Colombia: Choco (Coredó), *Rafael Romero 482* (US); Putumayo: basin of Rio Putumayo (frontera Colombo-Ecuatoriana, frente a Nueva Granada, alt. 390 m), *Idrobo 2628, 2632;* Amazonas/Vaupés: basin of Rio Apaporis, *Schultes & Cabrera 12782* (US). Ecuador (upper Bobonaza, 1900 ft.), *Charles C. Fuller 65*. British Guiana (Mazaruni Station), *Forest Dept. 6404*. Brazil: Para: *Ducke 1972* (near Belem); *Black 48–3070* and *Black & Foster 48–3328* (São Miguel do Guama); *Dardano & Black 48–3098* (basin of Rio Guama); *Froes & Pires 24101* (Rio Capim); *Froes & Black 24568* (Rio Itacaiuna, basin of Rio Tocantins); *Froes 27050* (Rio Vermelho; basin of Rio Tocantins); *Black & Ledoux 50–10673* (Faro); *Froes 31270* (Rio Curuana, Cachoeira do Portão). Territory of Amapa: basin of Rio Oiapoque, *Froes 25908*. Amazonas: basin of Rio Negro, *Schwacke 573, Pires 211; basin* of Rio Solimoes, *Froes 23947* (São Paulo de Olivença), *26367* (Lago de Badajos) and basin of Rio Jutai, *Froes 21030* (K).

This is the first record of the species from Venezuela, from Choco and Putumayo (Colombia) and from the Territory of Amapa (Brazil).

It is now apparent that this species is found at an elevation of 1030 m in the region of the Venezuelan Highlands.

LOCAL NAMES: Pux-ae-o (= Veneno caiman), or que-he-ae-o (= Bejuco carrasposo), or ya-yu-ae-o (= Veneno duro) (basin of Rio Putumayo, Putumayo, Colombia); chiu panga or payanchi fino (Quichua, Ecuador).

DISTRIBUTION: Venezuela (Bolivar); Colombia (Valle del Cauca, Choco, Putumayo and Amazonas/Vaupés); Ecuador (basin of Rio Pastaza; upper Bobonaza; British Guiana (Essequibo, Demerara and Berbice); Surinam; French Guiana; Brazil (basin of Rio Oiapoque, the Territory of Amapa; near Belem, near Catú, near Santarem, also in the basins of Rio Guama, of Rio Tocantins and of Rio Mapuera all in the State of Para; in the basins of the upper and of the lower Rio Negro, of Rio Tonantins, of Rio Jutai and of the upper and medium Rio Solimoes all in the State of Amazonas and in the State of Bahia); Bolivia (basin of Rio Mapiri, La Paz). Doubtless occurs also in Peru, and in the States of Maranhão, Piaui, Ceara, Rio Grande do Norte, Paraiba, Pernambuco, Alagoas and Sergipe in Brazil.

This species is one of the six which are found on the Pacific coast of Colombia. For further details on this, see under *S. panurensis*. It is one of the most frequently collected species, the others being *S. guianensis* and *S. brasiliensis*.

In Ducke's key made on the basis of fruit characters, it comes together with *S. Erichsonii* (31: 56).

Ducke and Froes note on labels of the specimens collected in the basin of Rio Tonantins that the plant is used in curare by the Cauichana Indians. It is occasionally used as a secondary curare ingredient by the Canelos in Ecuador (1: 293).

The collector states on the label (*Idrobo 2628*): "Con este se prepara veneno para flechas. Se raspa, se separa la cortesa, se reune con otros varios bejucos y se cocina en largo processo para preparar el veneno. Mata todo animal, pero no asienta en la preparacion." On the label of another specimen (*Idrobo 2632*) the collector states: "mata todo animal segun Tiburcio Payoguaje." On another specimen, which is also cited above (*Charles C. Fuller 65*), the label reads as follows: "bark scrapings used in curare preparation."

Fanshawe (34: 65) gives the following information on the local names, on the field characters of this bush-rope, on its distribution in British Guiana and its alkaloids, probably on the authority of Dr. King:

"LOCAL NAMES: Common devildoer; kwabanaro (Arawak); kumarawa (Akawaio, Arekuna, Patamona, Macushi).

"A canopy climber, to 5 inches in diameter; bark very rough, scaly, black-brown; slash off-white, soft, thicker than *S. diaboli* bark.

"It is generally distributed and occasional throughout the colony in rain- or dry evergreen forest on sandy or loamy soils.

"It contains at least two alkaloids, one of which has a weak curare-like action, i.e., causing paralysis of the peripheral nerves. It is used by the Akawaio and Arekuna Indians to prepare a blowpipe poison."

As per King, the alkaloid content of this species was found to be "0" (74). In another paper by the same author (75), the alkaloid content is given as "0," curare action, "none." All this work was done on *For. Dept. 2261*. In the second paper are given the results of the work on *For. Dept. 2621:* "alkaloid content "++," curare action "weak." These two specimens are from British Guiana and they were identified by N. Y. Sandwith (his letter to me of Nov. 4, 1963). It is not known what part of the plant was used for this work, presumably stem bark.

This species was under extensive studies by Karrer, Schmid and their coworkers (86) who isolated the following alkaloids; C-fluorocurinine, C-fluorocurarine (= C-curarine III), C-curarine I, C-calebassine (= Toxiferine II = C-strychnotoxine I), C-alkaloid I and C-alkaloids of groups B, C, and D. In their later paper (92: 440) the same authors list also C-alkaloid A as occurring in this species. This work was done on stem bark collected on Rio Vaupes, Brazil. The wood was found to be free of alkaloids. The authors give the following information on the procurement and identification of the sample and botanical specimen (86): "Durch die Freundlichkeit von Padre Antonio Giacone (Brasilien) erhielten wir Rinde einer Strychnosart, die Herr Prof. A. Frey-Wyssling, Zurich, Eid. Techn. Hochschule, als der *S. Mitscherlichii*-Gruppe angehörend identizierte."

This species was also studied by Marini-Bettolo, Bovet and their coworkers. For curare activity of the total extracts, see (108: 268). For rather extensive studies of the alkaloids of this species, see (97). In these studies 23 alkaloids were recognized by the use of chromatographic methods and the alkaloids which were characterized as follows: Alkaloid D, Calebassine, Fluorocurine, Mavacurine, Curarine (108: 269). The above referred to work was done on stem bark collected by Ducke near Belem, Para, Brazil in September 1953 (97: 1167).

34a. Strychnos Mitscherlichii var. **pubescentior** Sandw.

Brazil: Para: Catú: *Ducke 2032;* Amazonas: basin of Rio Solimoes (Rio Capitari, terra-firme, lowland), *Froes 26493*. Colombia: Vaupes (Rio Kuduyari, cerro Yapoboda, alt. 450 m), *Schultes & Cabrera 14401* (US); Amazonas (Rio Miritiparana, alt. 700 ft.), *Schultes & Cabrera 16271* (US).

This is the first record of this variety from Colombia and from the State of Para, Brazil.

DISTRIBUTION: Brazil (basins of the tributaries of Rio Solimoes, namely Rio Jutai, Igarape Belem and the lower Rio Javari in the State of Amazonas and near Catu, in the State of Para; Peru (basin of Rio Nanay, Loreto), and Colombia (Vaupes and Amazonas).

LOCAL NAMES: Nee-ma-mee-see-ma (Makuna Indians, Amazonas, Colombia).

Extensive collections of flowering and fruiting material throughout the range of *S. Mitscherlichii* and *S. Mitscherlichii* var. *pubescentior* are needed for evaluation of these two entities.

The collector's note on *Schultes & Cabrera 16271* reads: "poison (curare) vine."

35. Strychnos darienensis Seem. Fig. 1.

Brazil: Para: basin of Rio Curuatinga, *Froes 31602;* basin of Rio Jamundá, *Black & Ledoux 50–10727;* basin of Rio Tocantins, *Froes & Black 24378* (Maruba), *24452;* basin of Rio Tapajos, *Pires 3533* (US), *3721* (foz do Rio Juruena). Amazonas: basin of Rio Negro, *Froes 29614* (US), *29641;* basin of Rio Solimoes, *Froes 26410* (lago de Badajos), *Ducke 1109, Froes 23726* (both specimens are from the upper Rio Solimoes); basin of Rio Tonantins, *Froes 25554.* Peru. San Martin (Huahuiva to Sapasoa), *Woytkowski 5508* (M).

This is the first record of the species from the basins of Rio Tocantins and Rio Tapajos (Para) and of the basin of Rio Tonantins (Amazonas), Brazil, also from San Martin in Peru.

Pires 3721 is of interest as it has been collected near the boundary line of the State of Para with the States of Matto Grosso and Amazonas. Therefore this species doubtless occurs also in the State of Matto Grosso.

DISTRIBUTION: Costa Rica (Puntarenas); Panama (Canal Zone); Colombia (Valle del Cauca and between Misay and Timbiqui); Peru (Loreto and San Martin); British Guiana (Essequibo), and Brazil. In Brazil it has been collected in the State of Para (basins of Rio Amazonas, of Rio Jamunda, of Rio Tocantins and of Rio Tapajos); in the State of Amazonas (in the basins of Rio Negro, of Rio Solimoes, of Rio Tonantins, of the middle Rio Jurua, of Rio Jutai, of the lower Rio Javari and of the upper Rio Solimoes); in the Territory of Acre (basin of Rio Acre) and in the State of Bahia. We have also placed with this species, with doubts, a sterile specimen (*Krukoff 10936*) from the basin of Rio Mapiri, La Paz, Bolivia.

LOCAL NAMES: Su-Lija (San Martin, Peru).

The range of this species is very extensive. It is one of the six which are found on the Pacific coast of Colombia. For further details on this, see under *S. panurensis.*

It is satisfactory that Ducke's description of its fruits made on the basis of material from Brazil (31: 31, 57), matches closely our description of its fruits which we made on the basis of *Tonduz 7236* collected in Costa Rica (1: 294). For information on the position of this species in Ducke's key made on the basis of fruit characters, see under *S. rondeletioides.*

Said to be worthless as an arrow-poison component (*A. C. Smith 2837;* basin of Shodikar Creek, Essequibo, British Guiana) (1: 295).

Fanshawe (34: 66) gives the following information on the local names, and on its distribution in British Guiana:

"LOCAL NAMES: Devildoer; kwabanaro (Arawak); kumarawa (Akawaio, Arekuna, Patamona, Macushi).

"It occurs rarely in rain-forest in the upper Essequibo district."

II. INTERMEDIAE

Spineless bush-ropes or small woody vines with tendrils (absent or very rudimentary in *S. hirsuta;* the presence of tendrils on *S. Duckei* is accepted on the authority of Ducke); leaf-blades not drying yellow; inflorescences axillary; corolla-tube about 3 mm long, glabrous and more or less papillose without, lanate with long white hairs within throughout except at base; corolla-lobes lanceolate, equal to or somewhat shorter than tube (occasionally longer than tube in *S. cogens* and in some flowers of *S. guianensis* on the authority of Ducke), spreading or reflexed at maturity, pubescent on the whole face within or only on lower half; anthers linear-lanceolate, 0.8–1.5 mm long, well exserted, glabrous, filaments flattened and about as long as anthers or longer (up to twice as long); style glabrous or pilose near base, not papillose or hardly so; ovary glabrous or pilose on upper half.

Key to the species of *Strychnos* sect. *Intermediae*

1. Style glabrous; infl. loosely flowered, pedicels usually obvious.
  2. Plants macroscopically pubescent (except *S. glabra*); leaf-blades 1.5–12 cm long and 1.5–6.5 cm broad, principal nerves not impressed, reticulation usually faint or obscure (except *S. glabra*); infl. racemose and short, few (5–7)—flowered.
    3. Leaf-blades beneath with variable indumentum but not densely fulvous-velutinous, above not grey-glaucescent. (Basins of the Amazon and Orinoco.)
      4. Pubescence on infl. and midrib of leaf-blades beneath of adpressed or ascending hairs; leaf-blades subcordate to acute at base. (Species difficult to separate by key characters.)
        5. Leaf-blades comparatively well pubescent, 3–9 cm long and 1.5–4.5 cm broad, reticulation faint. 36. *S. guianensis.*
        5. Leaf-blades glabrescent, 4–12 cm long and 3–6.5 cm broad, more coriaceous than those of *S. guianensis,* usually more shining and of a metallic appearance, reticulation usually prominent. 37. *S. glabra.*
      4. Pubescence of ascending to spreading hairs; leaf-blades generally ovate-lanceolate and cordate to rounded at base. 38. *S. subcordata.*
    3. Leaf-blades beneath densely fulvous-velutinous, above grey-glaucescent and with conspicuous fulvous line on midrib. (Southern Brazil.) 39. *S. bicolor.*
  2. Plants macroscopically glabrous; leaf-blades with reticulation prominent on both surfaces; infl. generally compound and elongated, many flowered.
    6. Leaf-blades with fine closely intricate reticulation, the ultimate areolae being microscopic, drying greyish; anthers about 1.6 mm long; calyx-lobes about 1 mm long, strongly papillose or grey papillose-puberulent without. 40. *S. panurensis.*
    6. Leaf-blades with coarse reticulation, the ultimate areolae being rather open, drying yellowish; anthers about 0.8 mm long; calyx-lobes about 1.3 mm long, glabrous or sparsely hispidulous with pale-brown hairs without. 41. *S. Duckei.*
1. Style pilose at base; infl. compactly flowered, pedicels short or none; leaf-blades 6–20 cm long and 3–10 cm broad.
    7. Plants hirsute (hairs up to 1.5 mm long); calyx-lobes narrowly lanceolate, not becoming incrassate; leaf-blades with principal nerves and reticulation as in *S. panurensis.* 42. *S. hirsuta.*
    7. Plants not hirsute; calyx-lobes ovate to ovate-lanceolate, becoming incrassate; leaf-blades with principal nerves not impressed or lightly so.
      8. Ovary glabrous (apex rounded after anthesis); calyx-lobes ovate to ovate-lanceolate; pubescence on infl. of ascending to spreading, subsetulose, rusty hairs. 43. *S. cogens.*

8. Ovary pilose at apex (tapering after anthesis); calyx-lobes usually broadly ovate; pubescence on infl. of erect short pale hairs. 44. *S. Melinoniana.*

36. Strychnos guianensis (Aubl.) Mart.

Venezuela: Barinas: *Bernardi 1999.* Bolivar: basin of the middle Rio Orinoco, *Wurdack & Monachino 39790* (Rio Pargueni), *40967* (Rio Paraguaza); south of El Dorado, *Steyermark* and *G.C.K. & E. Dunsterville 93028;* cerro Venamo, near the boundary line with British Guiana, *Steyermark* and *G.C.K. & E. Dunsterville 92843.* Amazonas; basin of the upper Rio Orinoco, *Maguire & Wurdack 34609, Maguire, Wurdack & Bunting 37535, Ll. Williams 15971* (F, US, Ven); basin of the upper Rio Negro (Rio Castanha), *Cardona 1475* (Ven). Colombia: Putumayo: basin of Rio Putumayo, *Idrobo 2633.* Amazonas: Rio Miritiparana, *Schultes & Cabrera 16473* (US). Peru: *Poeppig 2918* (W). British Guiana: basin of the Mazaruni River, *Forest Dept. 6396.* Surinam: *Kappler 2148* (W). Brazil: Para: near Belem, *Pires 616;* basin of Rio Guama, *Pires & Silva 4613, 4630;* Temé-açu, *Pires 1439;* Curuça, *Guedes 33;* basin of Rio Jamundá, *Black & Ledoux 50–10704;* basin of Rio Arapiuns, *Pires & Silva 4195;* basin of Rio Tocantins (Rio Itacaiuna), *Froes & Black 24638;* basin of Rio Xingu (Rio Peri), *Froes 32476* (US); basin of Rio Tapajos, *Black 47–1033* (Belterra), *Froes 31650* and *31720* (planalto de Santarem). Territory of Amapa: basin of Rio Oiapoque, *Froes 25780* (US), *Pires 48564, Black 49–8303, 49–8535* (US). Amazonas: *Froes s.n.* (*Merck 51R6371*), *26136;* basin of Rio Negro, *Ducke 1926, Black 48–2793; Froes 22555, 22626* (Rio Padauiry), *22905, 25069, 29572* (US), *29653* (near Manaos); *Black 48–2636, 48–2665* (Rio Içana); basin of Rio Urubú, *Froes 25259;* basin of Rio Solimoes (Tefe), *Froes 26323, Pires 1322.* Territory of Rio Branco (Bôa Vista), *Ducke 1865, Black 51–13123.*

Steyermark et al. 93038 represents a rather unusual form and this specimen matches with another sterile specimen, *A. C. Smith 2836,* from British Guiana.

Two other specimens are of considerable interest. *Bernardi 1999* is from an elevation of 1300–1400 m and it shows that the species is found at such an elevation in subandean Venezuela. *Steyermark et al. 92843* is from Cerro Venamo, from an elevation of 900–1000 m and it shows that the species is found at such an elevation in the region of the Venezuelan Highlands.

LOCAL NAME: Ya-hi-ae-o (Rio Putumayo, in front of Nueva Granada, Putumayo, Colombia); Bee-see-reé-ta-rau-ee (Yukuna Indians on Rio Miritiparana in Venezuela).

DISTRIBUTION: By far the most frequently collected species of the genus in the Americas. It is well distributed in the basin of the middle and upper Rio Orinoco and throughout the entire basin of Rio Amazonas. The collections from Venezuela are from Barinas, Bolivar, and Amazonas; from Colombia, from Vaupés, Putumayo and Amazonas; from Ecuador, from Napo-Pastaza (Rio Pastaza); from Peru, from Loreto (Rio Nanay and Rio Mazan). Found also in the three Guianas. In Brazil it is well distributed in the State of Para (in the basin of Rio Trombetas, a northern tributary of the Amazon; along the Amazon River proper; in the basins of Rio Xingu, of Rio Tapajos and of Rio Tocantins, the southern tributaries of the Amazon, and in the basins of various small rivers draining to the Baia de Marajo and the Atlantic Ocean, such as Rio Acara, Rio Guama and others); in the Territory of Amapa (basin of Rio Oiapoque); in the Territory of Rio Branco; in the State of Amazonas (in the basins of Rio Urubú, of the lower and the upper Rio Negro, including its tributaries Vaupés, Içana, Cubate, Aiary and Padauiry, of Rio Jurua, of Rio Jutai, of Rio Solimoes and of Rio Javari) and in the State of Matto Grosso (Rio Juruena).

Ducke states (31: 32) that the species is found in the Territory of Acre, in the Territory of Guapore and Bolivia but I have not seen any specimens from these two territories and/or Bolivia. I also have not seen any specimens of this species from the basins of Rio Madeira and Rio Purus in the State of Amazonas. The species likely occurs in all these regions. It is also likely found at least in the western portion of the State of Maranhão.

It is not yet certain that this species occurs in the States of Espirito Santo and Minas Gerais. New collections are needed to verify its occurrence in these two States. We placed with this species with doubts (7: 8) *Glaziou 9944* deposited with Museu Nacional, Rio and said to have been collected in Espirito Santo. As far as *Glaziou 14095* and *19645* are concerned (these are cotype collections of *S. oblonga* Gilg), they doubtless belong with the species, but Ducke suggests that they probably bear the wrong labels. It is curious of course that of the seven important Glaziou's collections pertaining to three species, namely *S. pseudo-quina, S. guianensis* and *S. subcordata* and which are questioned as to the labels by Ducke (not as to our identifications), three specimens bear consecutive numbers: *Glaziou 14094—S. pseudo-quina; Glaziou 14095—S. guianensis,* and *Glaziou 14096—S. subcordata.* The first one is said to be from Rio de Janeiro and the other two from the State of Minas Gerais. Of the other three specimens, *Glaziou 9516—S. subcordata* (cotype coll. of *S. petrophila,* said to be from Rio de Janeiro) is followed by *Glaziou 9517—S. Castelnaeana* labelled as a cultivated plant at Rio de Janeiro, whereas *Glaziou 9944*—(?) *S. guianensis* (said to be from Espirito Santo) and *Glaziou 9945* (cotype coll. of *S. petrophila,* said to be from Rio de Janeiro) are preceded by three collections of cultivated plants at Rio de Janeiro (*Glaziou 9941—S. Jobertiana; Glaziou 9942—S. toxifera; Glaziou 9943—S. medeola*). I was unable to trace as to what specimens are next to *Glaziou 19645—S. guianensis* (cotype coll. of *S. oblonga,* said to be from Minas Gerais).

Since writing the above, I examined sterile specimen *Glaziou 9444* from Kew. On the label it is stated that it is of a cultivated plant [not from Espirito Santo, as stated on the label of the specimen of the same collection deposited with Museu Nacional, Rio (7: 8)]. This provides additional evidence for questioning labels as to the place of collection of seven specimens referred to above.

In our monograph (1: 293, 294) we placed *S. manaoensis* Barb. Rodr. with doubts in the synonymy under *S. darienensis,* and we discussed at length as to why we were unable to place it with confidence. In his paper Ducke makes an interesting observation (31: 14): "Quanto à *manaoensis,* Krukoff & Monachino a consideram com muita dúvida como forma da *darienensis,* mas o asunto ficou resolvido pelo colheita de una legitima *guianensis* em que algumas flores têm o tubo do corolla bem mais comprido que os lobos" (*Pires 1341;* Bol. Técn. Inst. Agron. Norte **19**: pl. 9, fig. A, B). I was unable to check on Ducke's disposition of this name as the specimen of this collection deposited at the N. Y. Bot. Garden does not have good flowers.

Fruits and seeds of this species are very similar to those of *S. subcordata,* but are bigger. For information on its position in Ducke's key made on the basis of fruit characters, see under *S. rondeletioides.*

The use of this species in curare is very widespread and it is often the main ingredient. Schreber in **1783** reported the species, under the name *Toxicaria americana,* as one of the components of curare of certain tribes of Indians in

Surinam. This has been confirmed and the specimens from this colony, which we cite in our monograph, were reported by Stahel and Geijskes as the main component of curare of the Indians of the upper Litanie. In British Guiana it is said to be the most important component of "Balauitu" (arrow-poison) of Wai-wai Indians (*A. C. Smith 2836* from the basin of Shodikar Creek, Essequibo Territory). It is noteworthy that the Wai-wais use chiefly the outer bark of roots. As per collector's notes on the label (*Croizat s.n.;* March 7, 1950; collected in the basin of Rio Paraguaza, Bolivar, near the north western boundary of the Territory of Amazonas, in Venezuela), the plant is "the basic ingredient in the making of curare by the Piaroa Indians." Humboldt and Bonpland mentioned "Curare" or "Bejuco de Mavacure" as one of the plants furnishing the ingredients of the poison as prepared by Indians at Esmeralda on the upper Orinoco in Venezuela. This plant is the basis of *S. Curare* which was placed by us under the species. The collector's note on the label (*Froes 12460*) indicates that the species is the main ingredient of curare, as it is prepared, on Rio Içana, in the basin of the upper Rio Negro, Amazonas, Brazil. Hoehne reports (*Mus. Nac. Rio 41615*) the use of the species by the Nhambiquaras on Rio Juruena in Matto Grosso. Bark of roots is used in preparation of the arrow-poison on Rio Putumayo in Colombia (*Idrobo 2633*); Schultes reports also its use in the same basin in Kofán curare (*Schultes 3688*). According to Gill, the plant is occasionally used as a secondary ingredient in curare of the Canelos in Ecuador (*Gill 27*).

Fanshawe (34: 67) gives the following information on the local names, on the field characters of this bush-rope, on its distribution in British Guiana and on its alkaloids, probably on the authority of Dr. King:

> "Local names: Devildoer; kwabanaro (Arawak); kumarawa (Akawaio, Arekuna, Patamona, Macushi).
>
> "A canopy climber, to 6 inches in diameter; bark brown, scaly.
>
> "It occurs occasionally in high forest and riparian forest on sands, loams, or clay soils in the North Central and North East districts, and in the upper Essequibo River, on hilly or flat lands.
>
> "It contains at least two alkaloids, one of which has a strong curare-like action, i.e., causing paralysis of the peripheral nerves. The bark of the roots is used by the Waiwai Indians in the preparation of an arrow poison."

As per King (75), the alkaloid content of this species was found to be "+ +," curare action, "weak" [*For. Dept. 4431* from British Guiana which is cited by us in (4: 345) under *S. guianensis*]. It is not known what part of the plant was used for this work, presumably stem bark.

For the reference of studies by King of *For. Dept. 2467* referred to by him as "near *S. guianensis*, but different from it and not conspecific," see under *S. glabra*.

This species was studied chemically and pharmacologically by Marini-Bettolo, Bovet and their coworkers on the basis of three collections made by Ducke. Two of these were of stem bark and one of root bark. The more detailed and interesting study is that of root bark, collected by Ducke from a very old and large vine near Curuça, Para, Brazil. Nine new alkaloids were isolated, namely Guiacurarine I, II, III, VIII, IX, Guiacurine I, II, Erythrocurarine I, II (100: 372). In this connection the authors make a very important observation: "Si tratta di corteccia di radice di un esemplare eccezionalmente vecchio e grande. La corteccia della stessa pianta non contiene neanche piccole quantità di alcaloidi" (100: 372).

From stem bark of a vine collected by Ducke on Estrada de Aleixo near Manaos, Amazonas, Brazil in April 1953, nine alkaloids were isolated, namely:

Guiacurarine I-VIII, and Guianine, whereas from stem bark collected by Ducke from a vine near Belem, Para, Brazil in April 1952 four alkaloids were isolated, namely: Guiacurarine II, VI, VII and Curarine (= C-Curarine I) (108: 269).

The authors make the following interesting observation: "Questi tre campioni . . . contengono lo stesso tipo di alcaloidi, seppure si possa notare una certa diversità nella loro composizione qualitativa e quantitativa. Nel compione di *Strychnos* di Belem e di Manaos gli alcaloidi sono contenuti nella corteccia, mentre nel campione di Curuça di cui disponevamo di radice e di corteccia, non si sono trovate nemmeno tracce di alcaloidi nella corteccia, mentre la radice della stessa pianta ne era ricchissima" (100: 361).

For the alkaloid content, toxicity and curare activity of the total extracts, see (25: 1142).

From another sample (? stem bark) collected by Ernani Ferreira near Manaos, Amazonas, Brazil in 1957, and determined by Ducke, the same authors isolated a new alkaloid, Urarine (104).

37. **Strychnos glabra** Sagot

British Guiana: *Schomburgk 957* (W), *Forest Dept. 2467* (K). Brazil: Para (Rio Mojú), *Froes 33940;* Amazonas: basin of Rio Negro (near Manaos), *Ducke 1925.* (US).

DISTRIBUTION: British Guiana (Essequibo and Berbice); French Guiana and Amazonian Brazil (in the State of Para it was collected on the upper Parú, in the basin of Rio Guama and near Catú; in the State of Amazonas, in the basins of the lower and upper Rio Negro and of Rio Solimoes; in the Territory of Rio Branco). Doubtless occurs also in Surinam, in Peru and Colombia.

In our monograph in 1942 we placed this species with reservations in the synonymy under *S. guianensis* and we reinstated it as a valid species in 1948, once the type coll. (*Sagot 829*) and good flowering and fruiting material of it (*Ducke s.n.*, Sept. 21, 1945) become available to us. At the same time we placed *S. Crevauxiana* in the synonymy under *S. glabra*, this after examination of the type of *S. Crevauxiana* (*Crevaux s.n.*, June 1879).

In his paper (31: 33) Ducke states: "A esta espécie, Krukoff atribue, como sinônimo, *S. Crevauxiana* Baill., uma das classicas plantas de curare. Foi coletada em estado florifero por Crevaux, no alto Rio Parú (Brazil, Estado do Pará e não Guiana francesa!) onde fornecia o veneno dos Indios Urucurianas ("Roucouyennes" na Guiana francesa). Fróes encontrou uma planta estéril, atribuida por Krukoff a *S. glabra* e muito parecida com o desenho da de Crevaux (Rio Negro, fóz do Içana, *Froes 21528*, "unica usada pelos indios Baniuas, para o veneno irari"); no entanto, na casca da *S. glabra* de Belem a Manaos não se observou atividade curarisante. Bovet e Marini-Bettolo encontraram n'ela um alcaloide de ação central paralisante. Mais material para estudias botânicos e quimicos sera necessario para resolver definitimente a questão da identidade da *S. Crevauxiana*!"

Let us consider carefully Ducke's suggestion and let us see as to whether or not the paralyzing activity of the extract of bark should enter into consideration in resolving the identity of *S. Crevauxiana*.

First let us quote as to what Ducke himself states on the paralyzing activity of the closely related *S. guianensis* (31: 33): "estudos quimicos, realizados em varias instituiçoes têm dado resultado muito variável quanto à atividade curarisante, fraquissima n'alguns casos, pelo que parece provável que sòmente certas raças d'esta polimorfa espécie forneçam veneno de flexas."

In another place in the same paper (31: 8) Ducke states: "A espécie *S. guianensis* (no sentido da monografia de Krukoff) varia não só naqueles caracteres mas ainda, na toxidez das amostras estudadas, forte em algumas, em outras quasi nula; não há no entanto dúvida que esta especie fornece curare a várias tribus de indios. Ignoramos se existe algum parlelismo entre a toxidez, e as caracteres morfológicos das diversas formas da espécie."

The variability in the paralyzing activity in the polymorphic and variable *S. guianensis* has been suspected and proof of this was obtained on actual experiments with this plant conducted at Merck Research Laboratories in the late thirties. However, this matter of the variability in the paralyzing activity is complicated by the parts of plants from which samples are collected (root bark or stem bark from the lower part of the stem or stem bark from the upper part of the stem), the age of plants, the season of collection, the method of preparation of samples, as well as by the age of samples on which assays are made.

Still in another place in the same paper (31: 16) Ducke also states: "Nenhuma relação existe entre as affinidades das espécies segundo os seus caracteres morfológicos, e a sua atividade curarisante."

If Ducke would be consistent then he also should have questioned our disposition of *S. Curare* H.B.K., the classical curare plant of the Indians at Esmeralda on the upper Rio Orinoco in Venezuela as reported by Humboldt and Bonpland (1: 299), and which is undoubtedly *S. guianensis*.

Ducke is probably correct in that the type collection of *S. Crevauxiana* was collected on the upper Parú, State of Para, Brazil, and not on the upper Parú, southern French Guiana, as we stated in our monograph (1: 298–299). On a new map of eastern South America (Atlas Plate 27; Sept. 1962; compiled and drawn in the Carthographic Division of the National Geographic Society) Rio Parú is clearly shown as being confined to Brazil.

In order to verify the status of *S. Crevauxiana*, Ducke should have examined the type collections of *S. glabra* and *S. Crevauxiana*. If these in his opinion were not sufficient for settling this question, then new collections are needed from the type locality of *S. glabra* (Karouany, French Guiana) and the type locality of *S. Crevauxiana* (basin of the upper Parú, Para, Brazil). *Froes 21258* from Fóz do Içana, Rio Negro, as well as the collections near Belem and Manaos, to which Ducke refers, are of little consequence for verifying the disposition of *S. Crevauxiana*. It is most unlikely that it could be reinstated as a good species, in spite of all temptations, as it is one of the historical curare plants.

For information on the position of *S. glabra* in Ducke's key made on the basis of fruit characters, see under *S. rondeletioides*.

The type of *S. Crevauxiana* was reported by Crevaux as the main ingredient of curare of the Trios and of the Roucouyennes. Froes states on the label (*Froes 21528* from Rio Içana, basin of the upper Rio Negro, Amazonas, Brazil): "unico usado pelos Indios Baniuas para o veneno 'Irary'."

Fanshawe (34: 67) gives the following information on the local names, on its distribution in British Guiana and on its alkaloids, probably on the authority of Dr. King:

"LOCAL NAMES: Devildoer; kwabanaro (Arawak); kumarawa (Akawaio, Arekuna, Patamona, Macushi).

"A canopy climber. It occurs rarely in wallaba forest on white sandy soil in the Eastern district.

"It contains at least two alkaloids, one of which has a strong curare-like action, i.e. causing paralysis of the peripheral nerves."

As per King, the alkaloid content of this species was found to be "+ +," curare action, "active" (75). This work was done on *For. Dept. 2620* (from British Guiana) which we cite under *S. glabra* (4: 345). In the same paper King also reports tests (the alkaloid content, "0", curare action, "none") for *For. Dept. 2467* referred to by him as "near *S. guianensis*" and which is cited as *S. glabra* in this paper.

It is not known what part of the plants was used for this work, presumably stem bark.

This species was studied by Marini-Bettolo, Bovet and their coworkers. For the alkaloid content, toxicity and curare activity of the total extracts, see (94: 856; 95: 1142, 1144). In another paper the same authors state: "alcaloides dotés d'une action sur le système nerveux central; activité curarisante, '0' " (108: 269). The above referred to work was done on stem bark collected by Ducke, one collection on Estrada Aleixo, Manaos, Amazonas, Brazil in April 1953, and another collection near Belem, Para, Brazil in April 1952 (95:1145; 108: 269).

38. **Strychnos subcordata** Spruce

Brazil: Territory of Amapa: basin of Rio Oiapoque, *Black 49–8180; Froes 25729*. Amazonas: basin of Rio Negro (near Manaos), *Ducke 2122;* basin of Rio Solimoes, *Froes 23695, 23900a*.

This is the first record of the species from the Territory of Amapa.

DISTRIBUTION: Brazil (basin of Rio Oiapoque in the Territory of Amapa; basins of the upper and lower Rio Negro, of Rio Tonantins, of Rio Içа and of Rio Solimoes in the State of Amazonas), and Colombia (basin of Rio Putumayo, Putumayo). Ducke (31: 34) refers to the collection from the basin of Rio Jurua but I have not seen this specimen. Doubtless occurs also in Peru and French Guiana.

Our disposition of *S. cordifolia* and of *S. petrophila* are not questioned by Ducke but he questioned the labels of *Glaziou 14096* (cotype of *S. cordifolia*) and *Glaziou 9516* and *9945* (cotypes of *S. petrophila*) (31: 34). For my comments on this, see under *S. guianensis*.

Fruits and seeds of this species are very similar to those of *S. guianensis* but are smaller. For information on the position of this species in Ducke's key, made on the basis of fruit characters, see under *S. rondeletioides*.

The type of *S. depauperata* (which we placed with *S. subcordata*) was reported by Jobert as one of the two species of *Strychnos* used by the Cauichanas (Rio Tonantins in the State of Amazonas, Brazil) in the preparation of curare, the other being *S. Jobertiana* (1: 300). The collector's note on *Museu Nacional 41653* (*Schwacke s.n.;* 1877; Manaos) reads: "Urary-uva . . . contendo o principio venenoso agita como o *S. Castelnaei* como a diferencia de ser menos efficaz" (3: 67). According to the collector, the plant (*Schultes 3687*) is used in Kofán curare (Putumayo, Colombia) (7: 9).

This species was studied chemically and pharmacologically by Marini-Bettolo, Bovet and their coworkers. For the alkaloid content, toxicity and curare activity of the total extracts, see (95: 1142, 1144; 108: 269). For rather extensive studies of the alkaloids of this species, see (101). In the summary the authors state that studies by the chromotographic methods demonstrated the presence of approximately 20 alkaloids. In the later paper (109: 141) the same authors list the following alkaloids isolated from this species: "Mavacurine, Desacetyldiaboline, Fluorocurarine (= C-curarine III), Fluorocurine, Erythrocurarine III, Guiacurarine III and X, Fluorocordatine; fluorescent alkaloids I and II."

The above referred to work was done on stem bark collected by Ducke on Estrada Aleixo, Manaos, Amazonas, Brazil in May 1953 (95: 1145; 101: 1165).

39. Strychnos bicolor Prog.

Brazil: São Paulo (Descalvado), *M. A. Pereira s.n.* (*Herb. Inst. Agr. do Norte 48298*).

DISTRIBUTION: Appears to be confined to the "cerrados" of the subtropical highlands of southern Minas Gerais and of northern São Paulo in Brazil.

According to Ducke (31: 34), *Glaziou 15239* (*type collection* of *S. calophylla*) is from campos de Aiuruoca (southern part of Minas Gerais) and this information was not available to us from the photo and a specimen of this collection which we examined.

This species is immediately distinguished from all other American species of the genus by the form, color and indumentum of its leaves.

Fruits and seeds of this species are now known and were described by Ducke (31: 35, 57), as very similar to those of *S. subcordata.* For information on its position in Ducke's key made on the basis of fruit characters, see under *S. rondeletioides.*

40. Strychnos panurensis Sprague & Sandw.

Venezuela: Apuré: *Foldate 3522* (US, Ven), *Lasser s.n.* (*Herb. Nac Ven. 49986*) (Ven). Bolivar: Rio Torono, *Killip 37422* (US); near Ciudad Bolivar, *Aristeguieta 4659* (Ven); basin of the middle Rio Orinoco, *Wurdack & Monachino 41195, 41281.* Amazonas: *F. Pannier-Schwabe 1057* (Ven). Colombia: Meta (Puerto Lopez), *E. L. Little & R. R. Little 8320.* Amazonas/Vaupés: *Schultes & Black 8447* (US) (Rio Loretoyacu), *Schultes & Cabrera 12840* (US) & *13084* (US) (both specimens from Rio Apaporis). Brazil: Amazonas: basin of the upper Rio Negro, *Froes & Addison 29013* (Rio Demini), *Schultes & Pires 9111* (Rio Vaupés).

This is the first record of the species from Apuré (Venezuela), also Meta, and Amazonas/Vaupés (Colombia). For comments on *Wurdack & Monachino 41195,* see under *S. pseudo-quina.*

DISTRIBUTION: Venezuela (Apuré, Bolivar, and Amazonas); Colombia (Choco, Meta, Putumayo, Vaupés, and Amazonas); Peru (Loreto, San Martin, and Junin); Brazil (basins of the upper Rio Negro and of the middle Rio Jurua in the State of Amazonas, and basin of the upper Rio Purus in the Territory of Acre).

As may be seen from the above distribution, this South American species has a very extensive range covering subandean Venezuela, Colombia and Peru; the basin of the upper and middle Rio Orinoco in Venezuela and the western part of the Amazon basin.

This species is one of the six which are found on the Pacific coast of Colombia, the other being the South-American *S. Mitscherlichii* (Valle del Cauca and Choco), and *S. colombiensis* (Valle del Cauca), also *S. Peckii* (Valle del Cauca), *S. darienensis* (Valle del Cauca), and *S. panamensis* (Antioquia) which are found in Central as well as in South America. *S. panurensis* doubtless occurs also in subandean Ecuador and Bolivia. It is very likely that this species is not found in the three Guianas, also in the State of Para and in the Territory of Amapa in Amazonian Brazil.

For information on the position of this species in Ducke's key made on the basis of fruit characters, see under *S. rondeletioides*.

For the record of the use of this species in curare in Venezuela (Puerto-Perico, et tout le long du Raudal d'Atures) (*Gaillard 16*) see (5: 13).

41. Strychnos Duckei Krukoff & Monachino, Lloydia **9**: 68. 1946.

This species is known only from the type collection made in the State of Amazonas (Tabatinga, near Marco, a few dozen meters from the Colombian boundary), Brazil. Doubtless it occurs also in adjacent Colombia and Peru.

A huge bush-rope of the high forest on terra-firme, provided with tendrils, as per Ducke. (No tendrils are present on the specimens available to me.)

The fruits of this species are still unknown. It would be important to collect and describe mature fruits and seeds and place this species in the proper place in the key made by Ducke, which is based on the fruit characters (31: 53–57). It also would be important to collect a series of specimens from various parts of mature and young plants so that we could distinguish it on the basis of sterile material with more confidence.

In the systematic arrangement of the species it has been placed by us next to *S. panurensis* (3: 68), to which it is obviously closely related, and it is not necessary to make any change.

42. Strychnos hirsuta Spruce

Corollas were not seen by us in 1942 and Ducke recently described them on the basis of a cultivated plant at I.A.N. raised from seeds collected by Pires at Maués, Amazonas, Brazil (33: 79, 80). As per Ducke corolla subglabrous without, and densely lanate within; corolla-tube 2–4 mm long; corolla-lobes about 3 mm long; anthers included, 1 mm long, filaments about 2.8 mm long; ovary and style pilose.

Illustration: Anais Acad. Bras. Cienc. **23**: 211, fig. e. 1951.

Brazil: Para (cultivated at Belem), *Pires 2638*. Amazonas: basin of Rio Madeira (Borba), *Froes 26108*.

Distribution: Known from four collections from the basin of Rio Madeira, one collection from the basin of Rio Maués, two collections from the basin of the lower Rio Negro (near Manaos), and three collections from the basin of Rio Solimoes proper—all from the State of Amazonas, Brazil.

Ducke (31: 35) questions our identification of *L. E. Mello Filho 567* (sterile specimen collected near Manaos) as of this species and places this specimen with *S. Froesii*. He goes on in saying that sterile specimens of *S. hirsuta* could be easily confused with those of *S. Froesii*.

I cannot accept Ducke's identification of the above referred to specimen as it is plainly *S. hirsuta*. I also believe that sterile specimens of this species could hardly be confused with those of *S. Froesii*, which are 5-plinerved, whereas they are invariably 3-plinerved in *S. hirsuta*. Branchlets, petioles and blades beneath (on principal nerves) of *S. hirsuta* are hirsute with long (up to 1.5 mm) rusty straight hairs and also with shorter curved inconspicuous hairs, and they are shorter in *S. Froesii*. Whereas *S. Froesii* is well provided with well developed tendrils, they are either absent or very rudimentary in S. *hirsuta* (on the specimens examined only one rudimentary tendril was seen on *Krukoff 6060*).

An excellent photograph and specimen are available at the N.Y. Botanical Garden of a plant in cultivation at I.A.N. at Belem from seeds obtained at Maués, Amazonas, Brazil.

Ducke (31: 35) provides an excellent description of this plant which I quote below: "Arbúsculo de poucos metros de altura, desprovido de gavinhas; tronco fraco e ramos flageliformes, algumas vêzes subescandentes na parte superior. Floresce no meio da estação chuvosa (março, em Maués); frutos maduros no verão. Restrita à submata da floresta pluvial primaria não inundável da parte central do Amazonas . . . Frutos e sementes . . . os que ví eram semelhantes aos de *guianensis* de tamanho maior, e, como estes, oblongos ou globosos."

For information on the position of this species in Ducke's key made on the basis of fruit characters, see under *S. rondeletioides.*

It appears that up to date this species was not studied chemically and/or pharmacologically. The reference of studies by King of *For. Dept. 2482* referred to by him as "near *S. hirsuta,*" will be discussed in the next supplement.

43. **Strychnos cogens** Benth.

Corollas were not seen by us in 1942 and Ducke recently described them on the basis of *Ducke 2150* from Parintins, Amazonas, Brazil (33: 79). As per Ducke, corolla "pulverulento-tomentelo" without; corolla-tube 6–7 mm long, glabrous at base, "lenhoso" at the middle; corolla-lobes 3–4 mm long, subglabrous; anthers included, 1 mm long, filaments 1 mm long; ovary pilose; style pilose at the basal part.

Brazil: Amazonas, basin of Rio Amazonas (Parintins), *Pires 1279;* basin of the lower Rio Negro (near Manaos), *Ducke 1986, 2120;* basin of Rio Jandiatuba, *Froes 23900.*

DISTRIBUTION: Known from Venezuela (Bolivar and Amazonas), British Guiana and Brazil. In Brazil it has been collected in the Territory of Rio Branco and in the State of Amazonas (Parintins, basins of the upper and lower Rio Negro and of Rio Solimoes, including basins of its tributaries, Rio Tonantins, Rio Jandiatuba, and Igarape Belem). Doubtless occurs also in adjacent Colombia and Peru. Sterile specimen with young leaves (*Schultes & Black 8525* from Colombia, Amazonas, Loretoyacu River, alt. about 100 m) was identified by us with doubts as of this species.

For information on the position of this species in Ducke's key made on the basis of fruit characters, see under *S. rondeletioides.*

According to the Schomburgk brothers, the species provides, under the name "Arimaru," an ingredient of curare of the Macusi Indians in British Guiana (1: 304). It is also reported to be used in preparation of curare in the basin of Rio Cuchivero, Bolivar, Venezuela (*L. Williams 13378*) (2: 23).

Fanshawe (34: 67) gives the following information on the local names, on the field characters of this bush-rope, on its distribution in British Guiana and on its alkaloids, probably on the authority of Dr. King:

"LOCAL NAMES: Devildoer; kwabanara (Arawak); kumarawa (Akawayo, Arekuna, Patamona, Macushi).

"A canopy climber, to 4 inches in diameter.

"It occurs rarely by ponds in the Rupununi savannas and in seasonal forest on the foothills of the Kanuku Mountains.

"It contains alkaloids with a curare-like action, i.e., paralyzing the peripheral nerves. It is used by the Macushi Indians in the preparation of a blowpipe poison called kumarawa, which is distinct from and inferior to the curare poison."

This species was studied by Marini-Bettolo, Bovet and their coworkers. For the alkaloid content, toxicity and curare activity of the total extracts see (95: 1142–1144). In another paper the same authors state: "alcaloides seulement en traces" (108: 269). The above referred to work was done on stem bark collected by Ducke on Rio Taruma, near Manaos, Amazonas, Brazil in May 1953 (95: 1145; 108: 269).

44. **Strychnos Melinoniana** Baillon

Surinam: *Lanjouw & Lindeman 2621*. Brazil: Territory of Amapa: basin of Rio Oiapoque, *Froes 25789* (US).

This is the first record of the species from the Territory of Amapa.

Distribution: Known only from the three Guianas and Amazonian Brazil. In Brazil it has been collected in the State of Para (basin of the middle Rio Tocantins) and on the authority of Ducke on a plateau between the rivers Xingu and Tapajos where it is rather common (33: 80); also in the Territory of Amapa.

Ducke in his paper (31: 37) states: "*S. Melinoniana* . . . até há pouco tempo era so conhecido nas três Guianas e parte adjacente do Brasil (Território do Rio Branco: Rio Cotingo, segundo Sandwith)." In his letter, to me of Nov. 4, 1963, N. Y. Sandwith wrote: "Ducke's citation of Rio Cotingo under *S. pedunculata*, following my identification, is his way of transferring to Brazil (perhaps rightly: look at the map) Schomburgk's B.G. locality cited by me as 'Cotinga River, W. of Pirara' (see Kew Bull. 1933, p. 397). However, in doing the same thing for *S. Melinoniana*, he seems to have slipped up: I never cited Schomburgk's specimen from the Cotinga River under *S. Melinoniana*, either in Hook. Ic. Pl. or Kew Bull., and there is no such specimen in the Kew Herbarium." This statement requires no comments.

For information on the position of this species in Ducke's key made on the basis of fruit characters, see under *S. rondeletioides*.

The collector states on the label "Warrow's ourali" (*Jenman 5198* (1: 305).

Fanshawe (34: 67) gives the following information on the local names, on the field characters of this bush-rope, on its distribution in British Guiana and on its alkaloids, probably on the authority of Dr. King:

"Local names: White devildoer; kwabanaro (Arawak); kumarawa (Akawaio, Arekuna, Patamona, Macushi).

"A grey canopy climber, to 6 inches in diameter; bark creamy, or grey, rough.

"It occurs occasionally in mora or rain-forest, usually on mora trees on low-lying loam or clay soils in the North Central district and the Arakari mountains.

"It contains an alkaloid without any curare-like action."

As per King, the alkaloid content of this species was found to be "+ +" (74). In another paper by the same author (75), the alkaloid content is given as "+," curare action, "none." All this work was done on *For. Dept. 2260, 2279, 2286* and *2303* (from British Guiana). The first collection is cited in (4: 347) whereas the third collection in (5: 13). The other two specimens were determined by N. Y. Sandwith (his letter to me of Nov. 4, 1963). It is not known what part of the plant was used for this work, presumably stem bark.

This species was studied also chemically and pharmacologically by Schlittler and Hohl (84). Two quaternary alkaloids were isolated (melinonine A and B) which do not possess any curare action. The above referred to work was done on the material (? stem bark) collected in Surinam.

A few years later Karrer, Schmid and their coworkers isolated various other alkaloids from this species (C-fluorocurine, C-mavacurine, melinonine E, F, G, H, I, K, L, and M) (90).

All of the alkaloids from this species were isolated and not only demonstrated by paper chromatography. As per Karrer & Schmid (93: 441) melinonine A = N-metho-pytetrahydro-alstonine; melinonine F = Harman-N(b)-methosalt and melinonine G = flavo-pereirine.

III. Breviflorae

Spineless bush-ropes with tendrils (*S. parviflora, S. Bovetiana* (?), *S. Castelnaeana, S. Torresiana, S. acuta, S. albiflora, S. pachycarpa* and *S. oiapocensis* (?)), small or large woody vines provided with both spines and tendrils (*S. rubiginosa, S. parvifolia, S. Grayi, S. nigricans, S. mattogrossensis, S. Schultesiana* (?), *S. malacosperma,* and *S. longisepala*), or shrubs or small trees armed with spines and devoid of tendrils (*S. Fendleri, S. Poeppigii, S. tarapotensis* and *S. brasiliensis*); inflorescences terminal (in *S. parviflora* and *S. Bovetiana* axillary), corolla-tube *very short* (longer than calyx and equal to or somewhat longer than corolla lobes in *S. pachycarpa*), essentially glabrous both without and within; corolla-lobes bearded within along an upwardly convex arc, otherwise with stray hairs or glabrous (except *S. parviflora*); anthers ovate-oblong and 0.5–1 mm long, rounded at base, usually more or less pilose, filaments shorter than anthers but distinct; style about as *long as ovary* or somewhat longer, glabrous or *puberulent* at base (not pilose), not papillose or lightly so; ovary glabrous or *puberulent* above.

Key to the species of *Strychnos* sect. *Breviflorae*

1. Infl. axillary; corolla-lobes pubescent on the whole face within or papillose and bearded along a line within; stigma sharply conical or capitate; leaf-blades 8–18 cm long. (Basin of the Amazon.)
  2. Stigma sharply conical; corolla-lobes pubescent on the whole face within; infl. in greatly elongated and paniculate thyrses; leaf-blades 8–18 cm long, pale glaucescent beneath. 45. S. *parviflora.*
  2. Stigma capitate; corolla-lobes papillose and bearded along a line within; infl. in small racemose thyrses; leaf-blades 8–13 cm long with no striking pallor beneath. 46. *S. Bovetiana.*
1. Infl. terminal; corolla-lobes bearded along a line within; stigma capitate.
  3. Leaf-blades 15–30 cm long and 7–21 cm broad, beneath densely fulvous-subhirtellous or velutinous, above impressed loose-reticulate and bullate; peduncles about 2.5 mm in diam. (Basin of the Amazon.) 47. *S. Castelnaeana.*
  3. Leaf-blades less than 15 cm long, not impressed-reticulate or bullate above; peduncles less than 2 mm in diam.
    4. Corolla-tube manifestly longer than calyx, equal to or longer than corolla-lobes, indumentum of greyish puberulence or none. (Basin of the Amazon.) 55. *S. pachycarpa.*
    4. Corolla tube shorter than calyx, manifestly shorter than corolla-lobes.
      5. Flowers not known; leaf-blades not verrucular, reticulation faint or obscure, midrib impressed above (leaves resembling *S. nigricans, S. mattogrossensis* and *S. malacosperma*); fruits large (± 4.5 cm in diam.), shells thin (± 1 mm thick), many seeded. (Basin of the Amazon.) 58. *S. Schultesiana.*
      5. Flowers known; combination of characters not as in the above species.
        6. Peduncles about 1 mm in diam., fulvous-subsetulose; leaf-blades velutinous to sparsely subhirtellous and tuberculate beneath, drying yellowish, slightly

paler beneath; branchlets and midrib beneath with hairs less than 1 mm long; calyx-lobes well ciliate.

7. Petioles 0–3 mm long; infl. with double indumentum (with spreading more or less straight hairs and short curved hairs); leaf-blades usually broadly elliptic to ovate-lanceolate, 3–6 cm long and 2–4 cm broad, subcordate to obtuse at base. (Southern Brazil.) 48. *S. rubiginosa.*

7. Petioles 0–1 mm long; infl. with hairs of various lengths; leaf-blades usually rhombic-ovate, 3–6 cm long and 3–8 cm broad, narrowed at base. (Northern and Central Venezuela.) 49. *S. Fendleri.*

6. Peduncles about 0.5 mm in diam. (?) *S. acuta,* lvs. glabrous.

8. Leaf-blades strikingly pale-glaucescent beneath; branchlets and midrib beneath with hairs greater than 1 mm long; petioles 0–3 mm long; blades 6–12 cm long and 3–5.5 cm broad. (Southern Brazil.) 50. *S. Torresiana.*

8. Leaf-blades not strikingly pale-glaucescent beneath and branchlets and midrib beneath glabrous or with hairs less than 1 mm long.

9. Leaf-blades in age conspicuously verrucular on nerves and veinlets, often subciliate; pubescence of subsetulose hairs; reticulation often prominent. (Basin of the Amazon and Southern Brazil.) 53. *S. parvifolia.*

9. Leaf-blades not verrucular; indumentum none or of greyish puberulence. (*S. brasiliensis* is sometimes densely soft-pubescent.)

10. Reticulation on leaf-blades prominent in both surfaces; leaves glabrous or merely barbate in the axils of principal nerves beneath; calyx-lobes broadly ovate, well ciliate.

11. Infl. in spherical clusters, small, dense and subsessile. (Amazonian Brazil and (?) French Guiana.) 60. *S. oiapocensis.*

11. Infl. not in spherical clusters. (Southern Brazil.)

12. Calyx-lobes glabrous without; infl. sparsely pubescent, few flowered. 51. *S. acuta.*

12. Calyx-lobes grey-puberulent without; infl. densely grey-puberulent, many flowered. 52. *S. albiflora.*

10. Reticulation faint or obscure, midrib impressed above.

13. Pedicels short but distinct; infl. not congested; calyx-lobes ovate or ovate-lanceolate or lanceolate, usually up to 1.5 mm rarely up to 2 mm long. (Species difficult to separate by key characters.)

14. Calyx-lobes usually sparsely ciliate.

15. Petioles 1–3 mm long; blades 1–8 cm long; branches usually not conspicuously dot-lenticellate and spines straight or slightly curved.

16. Corolla-lobes sparsely bearded within; leaf-blades 1–3.5 cm long and 0.4–1.8 cm broad; branches profusely spiny. (West Indies.) 54. *S. Grayi.*

16. Corolla-lobes usually well bearded; leaf-blades 2–8 cm long and 1.5–4 cm broad; branches sparsely spiny. (Basin of the Amazon.) 63. *S. tarapotensis.*

15. Petioles 2–7 mm long; blades 2.5–14 cm long; branches usually conspicuously dot-lenticellate, spines few and usually curved.

17. Fruits small (1–2 cm in diam.), shells thin (0.5–0.8 mm thick), seeds 1 or few per fruit. (So far known from Columbia, Venezuela, basin of the Amazon and the States of Maranhão and Ceara, Brazil.) 57. *S. mattogrossensis.*

17. Fruits large (3–5 cm in diam.), shells thick (5–8 mm thick), seeds 5–11 per fruit. (So far known from Mexico, Central America, basin of the Amazon and Southern Brazil.) 56. *S. nigricans.*

14. Calyx-lobes usually broadly ovate and well-ciliate; leaf blades neither barbate nor with pockets beneath. (Southern Brazil and Bolivia, Paraguay and Argentina.) 64. *S. brasiliensis.*

13. Pedicels none or very short; infl. congested and in spherical clusters (not in spherical clusters in *S. malacosperma* in which however calyx-lobes are linear-lanceolate, 2.5–3 mm long and glabrous);

calyx-lobes lanceolate or linear-lanceolate, 2–4 mm long. (Basin of the Amazon.)

18. Inflorescences not in spherical clusters, up to 6 cm long; fruits very large (5–10 cm in diam.), shells thick (3–5 mm thick), seeds—20–25 per fruit. 59. *S. malacosperma.*
18. Inflorescences in spherical clusters, less than 1 cm long; fruits very small (0.6–1.4 cm in diam.), shells very thin (0.5–0.6 mm thick) and papery, seeds—one (or two) per fruit.
    19. Peduncles long (about 20 mm); calyx-lobes lanceolate, about 2 (–2.5) mm long, not blackening upon drying. 61. *S. Poeppigii.*
    19. Peduncles none or very short (shorter than flower-cluster); calyx-lobes linear-lanceolate, 2–4 mm long, blackening upon drying. 62. *S. longisepala.*

45. Strychnos parviflora Spruce

DISTRIBUTION: So far this species has been collected only in Amazonian Brazil. In the State of Amazonas it has been collected in the basins of the upper and lower Rio Negro (where it is common), of the middle Rio Jurua, of Rio Jutai, of Rio Tonantins, of the lower Rio Javari and of the upper Rio Solimoes. Ducke (31: 38) refers to the collection from the basin of the middle Rio Tapajos (State of Para), to another collection from the basin of the lower Rio Madeira (State of Amazonas), and to still another from Rio Apuaú, basin of the lower Rio Negro (State of Amazonas) but I have not seen these specimens. Doubtless occurs also in adjacent Colombia and Peru.

Froes 21461 is of interest as it was collected on "Serra Cabara, 500 m, alto da serra" in the basin of Rio Negro, Amazonas. It is to be recalled that this species is common on the varzea land, also in the high forest on terra-firme.

Mature fruits of this species are now known and were described by Ducke (31: 38, 56). In his key made on the basis of fruit characters, it comes together with *S. macrophylla* and *S. amazonica* of *Longiflorae.*

46. Strychnos Bovetiana Pires, Bol. Técn. Inst. Agron. Norte **38**: 40. 1960.

The original description is ample and carefully drawn. It is the second known species of *Breviflorae* with axillary inflorescences, the other being *S. parviflora,* from which it is immediately distinguished by its leaves, inflorescences, and flower characters (for details, see the key).

Mature leaves of this species resemble somewhat those of *S. Erichsonii.* At least on the specimens examined, however, the leaf-blades are not tuberculate to blistered above.

ILLUSTRATION: Bol. Técn. Inst. Agron. Norte **38**: phot. 24. 1960.

TYPE LOCALITY: Para (munic. Ananindena, 30 km from Belem, between Marituba and Rio Guama, Companhia Pirelli), Brazil.

DISTRIBUTION: Known only from the type collection.

Brazil: Para (near Belem), *Pires 6987* (NY, type coll.).

A bush-rope from the high forest on terra-firme. Flowers were collected near Belem in July.

It is most unexpected that this very distinct new species was collected only 30 km from Belem, as this locality was so well searched for *Strychnos* by Ducke, Froes and other collectors associated with Instituto Agronomico do Norte.

Fruits of this species are still unknown and I also have not seen tendrils (which are expected to occur) on the specimens examined. The collection of fruits and a carefully selected series of leaves from various parts of mature bush-ropes (also of young plants) would be of considerable interest.

According to Pires, bark of this species was sent for chemical studies to Prof. D. Bovet (Rome) (l.c.).

47. **Strychnos Castelnaeana** Wedd.

Distribution: For information on its distribution, it is best to refer to Baillon, as his information given in 1879 is not only accurate but even cannot be amplified to any extent (1: 309). This species is known from the western part of the Amazon basin and its range is probably more or less similar to those of *S. javariensis, S. Smithiana* and certain other species, and is centered around the border common to Peru, Brazil and Colombia.

In the States of Amazonas, Brazil, it has been collected in the basin of the upper Rio Solimoes, (including its tributaries, Rio Iça and the lower Rio Javari). It has been collected in Peru and doubtless occurs also in adjacent Colombia.

It is curious that this plant (the famous "Guré" of the Tecunas) has never been collected by anyone who was not particularly interested in curare. In the 19th century it was collected only by Castelnau, Weddell, Jobert, Schwacke and Crevaux, whereas in modern times only by Froes and myself. It is incredible that Ducke (a "field botanist" as he used to refer to himself) never saw living plants of the two historical American species of *Strychnos*, that is, of *S. toxifera* and *S. Castelnaeana* (31: 23, 38), this in spite of persistent efforts to locate the latter near Esperança and Tabatinga on his numerous trips there and where both species doubtless occur. They look fascinating, probably because of their historical interest as they are entering curare as its main ingredient.

For information on the position of this species in Ducke's key made on the basis of fruit characters, see under *S. rondeletioides*.

This species is well known as the main ingredient of curare of Indian tribes inhabiting the basin of the upper Solimoes and its tributaries, that is, the region centering around the border common to Peru, Brazil and Colombia. It is of interest to note that in the first physiological experiments conducted by La Condamine in Leiden in 1745, the material used was the curare of the Tecunas of Brazil brought back by La Condamine from his trip across the South American continent, and therefore likely prepared of the bark of *S. Castelnaeana* as a main ingredient. This curare (pot curare), with *S. Castelnaeana* as the main ingredient, is still not known chemically, unlike "calabash curare" (with *S. toxifera* as the main ingredient) and "bamboo curare" (with *Chondodendron tomentosum*, as the main ingredient) which were studied recently by chemists very extensively.

This species was studied by Folkers & Unna in 1937. For the alkaloid content, toxicity and curare activity of the total extracts, see (39: 690, 691). This work was done on *Krukoff 7533, 7534, 7537, 7538, 7541,* and *7548* all from the basin of the upper Rio Solimoes, Amazonas, Brazil, and included samples of stem bark of mature plants, as well as stem and root bark of young plants. No alkaloids were isolated in this study.

48. **Strychnos rubiginosa** DC.

Brazil: *Riedel 549* (US). Paraiba (Areia), *Jayme Coêlho de Moraes 816.* Pernambuco (Recife), *Ducke & Lima 18.*

"Local name: Grão de Galo (Paraiba).

DISTRIBUTION: Confined to Brazil and has been collected in the following States: Piaui, Ceara, Paraiba, Pernambuco, Bahia, Matto Grosso and Rio de Janeiro. Specimens from Espirito Santo and Santa Catarina were placed by us here with reservations. The species doubtless occurs also in certain other States of Brazil situated outside of the basin of the Amazon.

An erect shrub becoming scandent above, provided with spines and tendrils.

Ducke makes a very useful observation to the effect that in his opinion numerous plants examined by him in the field in the State of Pernambuco doubtless pertain to a single species (31: 39).

For information on the position of this species in Ducke's key made on the basis of fruit characters, see under *S. rondeletiodes.*

Under poorly known *S. albiflora* and somewhat better known *S. acuta,* I discuss the necessity of additional collections. For a better understanding of these two species as well as for a satisfactory treatment of the extremely variable *S. rubiginosa,* good flowering material (plus a series of specimens from various parts of mature and young plants) of the latter (particularly from the States of Espirito Santo and Santa Catarina) is badly needed. It is to be recalled that in addition to twenty-four collections which we place with *S. rubiginosa*—without doubts—15 additional sterile specimens were cited by us under this species with doubts. They may belong to one or more entities and it may yet be necessary to reinstate *S. fulvotomentosa* as a valid species. This is amply covered in our previous papers (4: 348; 7: 10).

In our paper (4: 348) we cite 11 specimens from Espirito Santo tentatively under *S. rubiginosa* under provisional collectors' numbers (? *OVB-26,* etc.). In their paper (35: 10) Luiz Emygdio de Mello Filho and João de Souza Campos (two of the collectors) also have given the numbers of these specimens under which they are deposited with Museu Nacional do Rio de Janeiro and on a map facing page 16, they also indicated the precise localities of the collections of these 11 specimens.

For information on the tests of crude extracts of this species for curare-like action, see under *S. trinervis.*

This species was studied chemically and pharmacologically by Marini-Bettolo, Bovet and their coworkers. For the alkaloid content, toxicity and curare activity of the total extracts, see (94: 856); also (95: 1144). For rather extensive studies of the alkaloids of this species, see (96). In the summary the authors state that on extracting the plant a mixture of different alkaloids was obtained and 16 alkaloids were recognized by the use of chromatographic methods. The alkaloids which were characterized are as follows: "Alkaloid I, Calebassine (= Toxiferine II = C-strychnotoxine I), alkaloids of the group Curarine, Fluorocurarine (= C-curarine III), Fluorocurinine, Mavacurine" (108: 269). The above referred to work was done on stem bark collected by Ducke near Recife, Pernambuco, Brazil in July 1952 (94: 862; 95: 1145).

49. Strychnos Fendleri Sprague & Sandw.

Venezuela: Nueva Esparta: Margarita Islands, *Univ. de los Andes* (Merida, Ven.) *2467, 2501.* Anzoategui: *Foster D. Smith 115* (US). Sucre: *E. L. Little, Jr. 16095* (Ven). Bolivar: *E. L. Little, Jr. 17710* (Ven), *Steyermark 86266* (Ven), *Wurdack & Monachino 41239.*

This is the first record of the species from Nueva Esparta, Anzoategui and Sucre.

Distribution: This species seems to be confined to Venezuela where it is widely distributed in the drier tropics (Nueva Esparta, Zulia, Lará, Miranda, Guárico, Anzoategui, Sucre and Bolivar). It likely occurs also in northern Colombia in the region adjacent to Venezuela (Magdalena).

The species is a small tree armed with sharp spines and devoid of tendrils.

50. Strychnos Torresiana Krukoff & Monachino, Brittonia **6**: 348. 1948.

Illustration: Bol. Museu Nac. (nova serie), Rio de Jan. **13**: fig. a–e (not fig. f, g which are of *S. trinervis*). 1951.

Brazil: Espirito Santo (Victoria, Serra do Maruipe), *J. G. Kuhlmann 6663.* Rio de Janeiro (forest at the base of "Pico do Andarai"), *Ducke 2283.*
Boughan—N.Y. Botanical Garden—3795—Feb. 17

Distribution: Known to date only from the States of Espirito Santo and Rio de Janeiro in Brazil.

A huge bush-rope provided with tendrils.

This species was described on the basis of a sterile specimen and it is satisfactory that by now its flowers and mature fruits are known.

In the systematic arrangement of the species it has been placed by us between *S. Fendleri* and *S. acuta* on the basis of sterile material (3: 349) and its position was confirmed when its flowers became known (29: 4; 31: 40). It differs from *S. acuta* by the very characteristic pubescence (long spreading hairs up to 1.3 mm) of its branchlets, petioles and blades (at least along midrib and principal nerves beneath) and which are glabrous or nearly so in *S. acuta*. In *S. Torresiana* calyx-lobes are narrowly lanceolate, about 1.5 mm long and acuminate and anthers are glabrous at base, whereas in *S. acuta* calyx-lobes are broadly deltoid, somewhat less than 1 mm long, usually obtuse at apex (sometimes rather acute) and anthers are barbate at base.

For the description of its flowers, see (29: 3). The fruits described by Ducke in the same paper are those of *S. trinervis*.

For information on its position in Ducke's key made on the basis of fruit characters, see under *S. rondeletioides*.

An extract of bark of this species proved to have a strong paralyzing activity (37). In our paper (4: 349) we cite two specimens of *S. Torresiana* from Espirito Santo under provisional collectors' numbers (*"OVB–70"* and *"OVB–90"*). In their paper (35: 10), Luiz Emygdio de Mello Filho and João de Souza Campos (two of the collectors) also have given the numbers of these specimens under which they are deposited with Museu Nacional do Rio de Janeiro, and on a map facing page 16, they also indicated the precise localities of collection of these 2 specimens. The type collection (*OVB–70 = Museu Nac. Rio 47096*) was collected on July 23, 1942 near Lagoa das Palmas, about 25 km to the west of the town of Linhares, in the basin of Rio Doce.

This species was studied by Marini-Bettolo, Bovet and their coworkers. For the alkaloid content, toxicity and curare activity of the total extracts, see (95: 1142). The above referred to work was done on stem bark collected by L. E. de Mello Filho, one collection near Grajau, Rio de Janeiro, Brazil in July 1953 and another in Espirito Santo, Brazil (95: 1142; 108: 269).

In the later paper (108: 269) the same authors referring to the alkaloids of this species state: "plusieurs alcaloides actuellement à l'etude."

51. Strychnos acuta Prog.

Brazil: São Paulo (Serra da Cantareira, perto da capital, where it is said to be common), *Ducke 2282*. I have not seen another specimen from the State of São Paulo (Ubatuba)—*A. P. Viegas s.n.* (*Inst. Agr. Campinas 5483*) cited by Ducke (31: 41) who also gives a precise locality for *Saldanha s.n.* (*Museu Nac. 31888*) which we placed with this species. It has been collected "entre Bananal e Barreira do Soberbo, perto de Terezópolis" in the State of Rio de Janeiro.

DISTRIBUTION: Known only from the States of Espirito Santo, Rio de Janeiro, and São Paulo in Brazil.

Erect shrub becoming scandent above and provided with tendrils.

It was a difficult task in 1942 to reconstruct this species on the basis of a fragment and a photo of the type collection (*Gaudichaud s.n.*) and a single poor specimen of *Saldanha s.n.* By now it is apparent that this species is closely related to *S. Torresiana*. For further details on this, see under the above referred to species.

For information on its position in Ducke's key made on the basis of fruit characters, see under *S. rondeletioides*.

As per Ducke, a somewhat bitter infusion of its leaves is used in popular medicine in the State of São Paulo ("cha paulista") (31: 41).

New collections of this species in flower (particularly from the State of Espirito Santo) are needed. It would be of particular interest to collect a series of specimens from various parts of mature and young plants so that we could distinguish it on the basis of sterile material with more confidence.

In our paper (4: 349) we cite two specimens of *S. acuta* from Espirito Santo under provisional collectors' numbers (*"OVB-58,"* etc.). In their paper (35: 13) Luiz Emygdio de Mello Filho and João de Souza Campos (two of the collectors) also have given the numbers of these specimens under which they are deposited with Museu Nacional do Rio de Janeiro, and on a map facing page 16, they also indicated the precise localities of collection of these two specimens.

The total extracts of this species was tested on curare activity with negative results by Marini-Bettolo, Bovet and their coworkers (105: 960; 108: 269). The above referred to work was done on stem bark collected in São Paulo, Brazil (108: 269).

52. Strychnos albiflora Prog. in Mart. Fl. Bras. **6**: 279. 1868.

Brazil: Rio de Janeiro: *Glaziou 9520* (K).

In the absence of botanical specimens, this species was placed by us under doubtful species in our monograph. We reinstated this as a valid species in 1948 (4: 349) once the type collection (*Luschnath s.n.;* 1833) from the State of Rio de Janeiro ("in valle Laranjeiras et Monte Corcovado"), Brazil became available. Together with this species we placed provisionally 14 sterile collections from the State of Espirito Santo collected by Luiz Emygdio de Mello Filho et al., in the basin of Rio Doce. The only other collection of this species available is a sterile sheet (*Glaziou 4097*) from Rio de Janeiro.

As we stated in 1948 (4: 350): "additional flowering material of *S. albiflora* with several sheets amply representing the variations in leaves would be of considerable interest, as such a collection would permit the better understanding of the species which is at present definitely known only from the type collection."

The fruits of this species are still unknown. It would be important to collect and describe mature fruits and seeds and place this species in the proper place in the key made by Ducke, which is based on the fruit characters (31: 53–57).

In the systematic arrangement of the species this poorly collected and poorly understood species has been placed by us next to *S. acuta* (4: 349) to which it is obviously closely related and it is not necessary to make any change at this time.

In our paper (4: 350) we cite fourteen specimens from Espirito Santo tentatively under *S. albiflora* under provisional collectors' numbers (*"OVB–2,"* etc.). In their paper (35: 13) Luiz Emygdio de Mello Filho and João de Souza Campos (two of the collectors) also have given the numbers of these specimens under which they are deposited with Museu Nacional do Rio de Janeiro, and on a map facing page 16, they also indicated the precise localities of collection of these 14 specimens.

For information on the tests of crude extracts of this species on curare-like action, see under *S. trinervis*.

53. Strychnos parvifolia DC.

Brazil: Para: basin of Rio Tocantins, *Froes & Black 44756* (Maraba, Rio Itacaiuna), *Froes 23529* (Tucuruhy to Breu), *26981* (Rio Vermelha). Maranhão (Imperatriz), *Pires & Black 1733a*. Rio Grande do Norte (south of Natal), *Wurdack B–207*.

The first record of the species from the State of Rio Grande do Norte and also from the basin of Rio Tocantins.

Distribution: This polymorphic and variable species has a very extensive range which is very different however from those of all other members of the genus as it is confined to a special habitat. As far as the State of Para (Brazil) is concerned, it is confined to patches of forests in savannas and secondary forests (collected near Obidos, near Alenquer, near Santarem, on Serra de Pirocaua, and in the basins of Rio Tapajos and Rio Tocantins where it is common). Farther south in Brazil, it has been collected in Maranhão (on the Island of São Luiz, as well as near Imperatriz on the border of the State of Maranhão with the State of Goias), Goias, Piaui, Ceara, Rio Grande do Norte, Bahia, Espirito Santo, Rio de Janeiro and São Paulo, usually in open situations. Ducke states (31: 42): "em Minas, segundo Mendes Magalhães a planta é commum, em Pirapora (Rio San Francisco)" but I have not seen any specimens of this species from the State of Minas Gerais. This species doubtless occurs also in the States of Matto Grosso, Paraiba, Pernambuco, Alagoas and Sergipe. It has been also collected in Paraguay and Bolivia (in savannas of Santa Cruz).

Mature fruits and seeds of this species are well known and were described by us (1: 312) and by Ducke (31: 42, 56).

Soon after our monograph appeared in print, Ducke wrote to me and he questioned our concept of this species, stating that an erect shrub of Ceara is different from a slender vine of the State of Para. We exchanged several letters on the subject and these are now deposited with my files with the Smithsonian Institution. It is very satisfactory that eventually Ducke accepted our concept of this polymorphic and variable species.

In our paper (7: 11) we cite six specimens of *S. parvifolia* from Espirito Santo under provisional collectors' numbers (*"OVB–14,"* etc.). In their paper (35: 11) Luiz Emygdio de Mello Filho and João de Souza Campos (two of the collectors) also have given the numbers of these specimens under which they are deposited with Museu Nacional do Rio de Janeiro, and on a map facing page 16 they also indicated the precise localities of collection of these six specimens.

For information on the tests of crude extracts of this species on curare-like action, see under *S. trinervis.*

This species was studied chemically and pharmacologically by Marini-Bettolo and his coworkers. The toxicity of the alkaloids of this species is said to be "slight" (103: 51), curare action "+ +" (108: 269). For rather extensive studies of the alkaloids of this species, see (103). In the summary the authors state: ". . . 4 alkaloids have been isolated and described for the time as being alkaloids *S. parvifolia* I, II, III, IV. These alkaloids have not yet been met with in other plants."

The above referred to work was done on stem bark collected by Ducke near Fortaleza, Ceara, Brazil in 1958 (103: 53).

54. Strychnos Grayi Griseb.

Cuba: *Bro. Alain 2912, Eggers 5368* (A); Pinar del Rio, *Bro. Alain 4270* (GH).

DISTRIBUTION: Cuba (Pinar del Rio, Isla de Pinos, Habana, Santa Clara, Camaguey and Oriente) and the Island of Haiti (or Hispaniola) in the Dominican Republic. Doubtless occurs also in the Republic of Haiti.

This species is the only member of the genus which is found in the West Indies, not considering the South American *S. pedunculata* which occurs in Trinidad. This island is usually considered as a part of South America floristically.

As is the case with the majority of species of *Breviflorae,* which are spiny shrubs (not bush-ropes of the same section) this is one of the most uninteresting species of the genus.

The available collections of this species clearly illustrate the need of botanical explorations of the Island of Haiti, probably the most poorly collected island in the West Indies. Of the twenty-two collections of this species only one collection was made by Ekman in Haiti, although the species doubtless is rather common on low calcareous hills, in rather low and open forest on the Island.

In Ducke's key made on the basis of fruit characters, this species should be placed together with *S. brasiliensis* (33: 86). Fruits and seeds of *S. Grayi* are very similar to those of *S. brasiliensis* but are somewhat smaller.

55. Strychnos pachycarpa Ducke, Bol. Técn. Inst. Agron. Norte **3**: 15. 1945.

ILLUSTRATION: Bol. Técn. Agron. Norte **3**: pl. 1 (fig. 1–5), pl. 2 (fig. 1–3). 1945.

Brazil: Amazonas: basin of Rio Negro (silva primaria, noninundabili; ultra Coloniam João Alfredo), *Ducke s.n.* (Jan. 30, 1943, in fruit), *1403* (Oct. 16, 1943, in flower) (*type coll.*).

Known only from two collections made from the same plant. The first collection of this plant made by Ducke on Jan. 30, 1943, was sent to us for identifications (only leaves were sent) and I wrote to Ducke that it is probably of a new species, which however we do not want to describe in the absence of flowers. This specimen (*Ducke s.n.,* Jan. 30, 1943) with our annotation label is deposited at The New York Botanical Garden. On Oct. 16, 1943 Ducke obtained the flowering specimen from the same plant (*Ducke 1403*) and he described this as a new species.

This species has been reviewed by us in detail (3: 70). However, as at that time we had not seen its fruits, they were described by us from Ducke's description. A more complete description of fruits is now available (33: 85) and as per Ducke, this species is immediately distinguished from all of the members of *Breviflorae* by its fruit characters.

In the systematic arrangement *S. pachycarpa* belongs with *S. nigricans* to which it bears a general resemblance in many respects.

This species was studied by Marini-Bettolo, Bovet and their coworkers. For the alkaloid content, toxicity and curare activity of the total extracts, see (95: 1142; 1144). In another paper the same authors state: "Only tertiary bases" (109: 141). The above referred to work was done on stem bark collected by Ducke north east of Colonia Campos Sales, Manaos, Amazonas, Brazil in May 1953 (95: 1145; 108: 269).

56. Strychnos nigricans Prog. in Mart. Fl. Bras. **6**(1): 280. 1868.

Strychnos brachistantha Standley, Field Mus. Publ. Bot. **12**: 412. 1936.

ILLUSTRATION: Bol. Técn. Inst. Agron. Norte **30**: fig. 9, 10, as *S. brachistantha*. 1955.

Mexico: Jalisco: *Mc Vaugh 20978* (fruits) (Mich); Tabasco (mun. Macuspana), *Gilly & Hernandez 384* (fruits) (Mich). British Honduras: *Peck 832* (GH). Guatemala: Alta Verapaz, *Krukoff s.n.* (Apr. 1963) (fruits), *Steyermark 44933* (US). Nicaragua: Zelaya (near El Recreo), *Standley 19416* (F), *19788* (F). Brazil: Para: planalto between Xingu and Tapajos, *Froes 32488* (fruits). Minas Gerais (Viçosa), *J. C. Kuhlman 2515* (US). São Paulo (native to Jard. Bot.), *Moyses Kuhlmann 2728* (US). Rio de Janeiro (Serra Tingua), *Schott 5486* (W) (*type coll.*)

LOCAL NAME: "Ichbolay" (Alta Verapaz, Guatemala).

The type collection of *S. nigricans* is from Serra Tingua, Rio de Janeiro, Brazil and it was not seen by us in 1942. We have accepted Sandwith's and Ducke's interpretation of this species (1: 316). The type collection is in flower.

The type collection of *S. brachistantha* (*Schipp S–899* from Temash River, British Honduras) is also a flowering specimen.

In our monograph we placed *S. mattogrossensis* and *S. mattogrossensis* var. *sarmentosa* (type coll. of these two are from Matto Grosso, Brazil) under *S. nigricans*.

We described the differences between *S. nigricans* and *S. brachistantha* (pubescence of inflorescences and leaf-blades) in our key (1: 306) and under *S. nigricans* (1: 315), and we stated under *S. brachistantha:* "this species is so similar to *S. nigricans* that its specific rank should be held under suspicion until further studies are made in the geographical distribution of both entities, especially in the critical zone of south-eastern Colombia."

In our monograph and all subsequent papers, very little attention was paid by us to the fruit characters and we so stated in 1942 (1: 258). Our keys were based exclusively on flower and vegetative characters. Ducke is quite correct in criticizing us on this point and he is also quite correct in pointing out the reasons why we were neglecting fruit characters (31: 12), one being that fully mature fruits were very poorly represented in the herbaria, and another reason being that my important *Strychnos* collection from the basin of the upper Rio Solimoes was made in the dry season at which time only a few immature fruits were available.

From 1942 to 1955, mature fruits of many species were newly collected and at the time when Ducke was working on his paper on *Strychnos* (31), mature fruits of 45 Brazilian species were available to him for studies. It became apparent that in *nigricans-brachistantha* complex there is an entity with large fruits and thick shells and also an entity with small fruits and thin shells and they are excellently illustrated in Ducke's paper (31). Ducke tentatively applied the name of *S. brachistantha* to the entity with large fruits and thick shells and *S. nigricans* to the entity with small fruits and thin shells and he left it to "bureau-botanists" to be concerned with the nomenclature, adding that a "field-botanist" studies plants and not names (31: 47).

The name of *S. nigricans* cannot be applied to the small fruited entity with thin shells as the type coll. of it (in flower) is from the State of Rio de Janeiro where up to date no small fruited entity has been collected. It is necessary therefore to reinstate *S. mattogrossensis* as a valid species and interpret it as a small fruited entity with thin shells. The type collection of *S. mattogrossensis* (*Moore 6725*) is in flower but the type collection of *S. mattogrossensis* var. *sarmentosa* is in fruit. They are from the same locality and I interpret *S. mattogrossensis* as of the same entity as *S. mattogrossensis* var. *sarmentosa.*

Presently I have no alternative but to reduce *S. brachistantha* (with reluctance) to the synonymy of *S. nigricans*. Originally I thought that their ranges are widely separated, but a recent collection (*Froes 32488* with large fruits and thick shells) from the State of Para (planalto between Rio Xingu and Rio Tapajos) Brazil exploded this criterion. In their flower and vegetative characters they are very close, and we have separated them in our key on rather weak characters (1: 306). I have not seen a single collection of *S. nigricans* from Southern Brazil in fruit, but fruits were well illustrated by Ducke. They were drawn from *J. G. Kuhlmann 1584,* collected near Viçosa, Minas Gerais, Brazil. It is not clear however as to why this specimen is not cited by Ducke elsewhere in his paper (31: 45).

It is quite likely that once this complex with large fruits and thick shells presently treated as *S. nigricans* is well studied in the field as well as on the basis of cultivated plants grown from seeds collected in Central America, and as well as from the Amazon basin and from Southern Brazil, two or more entities will be recognized.

DISTRIBUTION: As I presently interpret this species, it has been collected in Mexico (Jalisco, Vera Cruz and Tabasco); British Honduras (where it is common); Guatemala (Izabal, Huehuetenango and Alta Verapaz); Nicaragua (Zelaya), and Panama (Canal Zone).

Of 22 specimens from Mexico and Central America, which were available to me to date, only five are in fruit (*Gentle 3181* and *Lundell 6266* from British Honduras and three recent collections cited in this paper).

Only one collection in fruit (*Froes 32488*) is available from the Amazon basin.

According to Ducke (31: 45) four collections of this species in fruit from Southern Brazil were seen by him and they are as follows: Brazil, Minas Gerais (Viçosa), *J. G. Kuhlmann s.n.* (*Herb. Viçosa 1515* and *Jard. Bot. Rio 45535*). Rio de Janeiro (Itatiaia, alt. 800 m, Parque National), *Brade 17544* (with immature fruits). São Paulo: *Moyses Kuhlmann 2608* (near São Paulo, forest reserve of Inst. de Bot.); *Hoehne s.n.* (*Inst. de Bot. 12894*) (Cabreuva).

Thirteen specimens sterile or in flower from Minas Gerais, Rio de Janeiro and São Paulo, were seen by me. Therefore they are from the same States as the specimens in fruit seen by Ducke.

For information on the position of this species in Ducke's key made on the basis of fruit characters, see (33: 85, 86, under *S. brachistantha*). The largest fruit of this species seen by me from a collection from Guatemala measures 5.0 cm in diam. with a shell 5.1 mm thick.

57. Strychnos mattogrossensis S. Moore, Trans. Linn. Soc. II. **4**: 392. 1895.

S. mattogrossensis var. *sarmentosa* S. Moore, Trans. Linn. Soc. II. **4**:393. 1895.

Illustration: Bol. Técn. Inst. Agron. Norte **30**: fig. 11, as *S. nigricans*. 1955.

Venezuela: Zulia: (?) *Curran ZM36;* Yaracuy: (?) *Steyermark 56873* (F). Peru: Loreto (Paca-Cocha, alt. 200 m). *Woytkowski 6308* (fruits) (M). Brazil: Para: *Archer 7579* (fruits) (cult. J. B. Museu Goeldi), (?) *Froes & Black 24450* (Rio Itacaiuna), *Black 47–1954* (fruits) (Rio Pixuna, 40 km acima da bôca do Cupari); Amazonas: basin of Rio Solimoes, *Froes 23769* (fruits), *23942* (fruits), *23954* (fruits), (?) *Ducke 1773* (F, US); Maranhão: basin of Rio Pindare, *Froes 20329* (fruits); Ceara (Serra de Aratanha), *Guedes 554* (fruits) (US).

See under *S. nigricans* for detailed explanations as to why I find it necessary to reinstate this as a valid species, and which we placed in synonymy under *S. nigricans* in 1942 (1: 315). It is immediately distinguished from the related *S. nigricans* and *S. Schultesiana* by its small fruits with thin shells which are well illustrated by Ducke. They were drawn from *Ducke 1613,* from a plant cultivated at Mus. Par. which was raised from seeds collected in the basin of Rio Purus, Amazonas, Brazil. Flowers and fruits immediately set it apart from the more distantly related *S. malacosperma,* which however is very difficult to separate on the basis of sterile specimens.

Distribution: In addition to eight collections in fruit cited above [they are from Peru (Loreto) and Brazil (Para, Amazonas, Maranhão and Ceara)] the following ten specimens in fruit (and/or with fruit pedicels) of this species were available to me for examination: Colombia: Bolivar: *Curran 73, 418.* Venezuela: Amacuro: *Rusby & Squires 216.* Bolivar: *L. Williams 12066.* Brazil: Para: *Ducke 1613* (cult. Museu Par.). Amazonas: basin of Rio Madeira, *Krukoff 6745;* basin of the lower Rio Negro (near Manaos), *Ducke s.n.* (Febr. 11, 1947); basin of Rio Solimoes, *Krukoff 7849, Froes 20634* (Fonte Bôa). Matto Grosso: *Moore 569* (type coll. of *S. mattogrossensis* var. *sarmentosa*).

Sixteen specimens in flower (or sterile) from the basin of the Amazon, which however cannot be placed with confidence with this species as they may belong with *S. nigricans* and/or *S. Schultesiana,* are available and they were seen by me. Of particular interest are specimens from the basin of Rio Parú in the State of Para, and from the basins of the Rivers Purus, Jurua, Japura, Iça, all from the State of Amazonas, Brazil, also from the basin of Rio Itaya, Loreto, Peru. Specimens in fruit were not collected as yet from these regions.

Outside of the basins of Rio Amazonas and Orinoco, I have seen three Froes' specimens from the basins of Rio Pardo and Rio Santa Ana, State of Bahia, and ten specimens collected by Luiz Emygdio de Mello Filho et al., in the basin of Rio Doce, State of Espirito Santo, Brazil. None of these is in fruit and under the circumstances we do not know as yet as to whether they are of *S. mattogrossensis* and/or *S. nigricans* and/or of *S. Schultesiana.* Further collections in fruit are badly needed from these two States.

The leaves of Karsten's specimen from Magadalena, Colombia (type coll. pro part of *S. hachensis*) deposited with Leningrad Herbarium have to be identified now with doubts as of *S. mattogrossensis* as no specimens in fruit of *S. nigricans* have been collected in Colombia.

In Ducke's key made on the basis of fruit characters, this species comes together with *S. Poeppigii, S. longisepala* and *S. tarapotensis* (33: 86).

In our paper (4: 351) we cite ten specimens from Espirito Santo (under *S.*

nigricans) under provisional collectors' numbers (*"OVB–5,"* etc.). In their paper (35: 12) Luiz Emygdio de Mello Filho and João de Souza Campos (two of the collectors) also have given the numbers of these specimens under which they are deposited with Museu Nacional do Rio de Janeiro, and on a map facing page 16, they also indicated the precise localities of collections of these ten specimens.

58. Strychnos Schultesiana Krukoff, sp. nov.

Ad sectionem *Breviflorae* referenda, *S. mattogrossensi* et *S. malacospermae* affinis sed fructu majori tenuius testaceo absimilis.

Frutex scandens spinis armata (cirrhis non visis); folia ut in *S. mattogrossensi, S. nigricanti* et *S. malacosperma;* inflorescentiae terminales; fructus pedicello incrassato (diametro ±9 mm.) gestus, globosus, diametro ±4.5 cm., maturus luteus nitidus, polyspermus, cortice ±1 mm. crasso; testa fibris mollibus tenuibus intertextis constituta dein ab endospermo contracto libera et eum more sacci continens; semina testa ablata irregulariter oblique pyramidalia obtuse 3-angulata ad ±1 cm. usque longa, 0.6 cm. lata.

Macroscopic: petioles 3–4 mm long; blades ovate-lanceolate to ovate, 4.7–9.5 cm long, 2.8–3.7 cm broad, rounded at base, acuminate and finely pointed at apex, dull on both surfaces, membranaceous to chartaceous, 3-plinerved with the inner pair subopposite or alternate and diverging at 0–3 mm from base, midrib impressed above, reticulation faint especially above. *Microscopic:* branchlets and petioles puberulent with short erect or ascending hairs, becoming glabrescent or glabrous; blades beneath puberulent with short erect or ascending hairs, becoming glabrescent or glabrous; blades beneath puberulent on principal nerves when young, otherwise glabrous.

Fruits not completely mature globose, about 4.5 cm in diam.; shells about 1 mm thick, shining, tuberculate; seeds many; testa fibrous, breaking away from the shrunken endosperm and enclosing it like a sac, composed of fine fibers, felt-like; seeds with testa removed irregular, in bluntly 3-sided oblique pyramids up to about 1 cm long, 0.6 cm broad. Flowers not seen.

TYPE LOCALITY: Amazonas (basin of Rio Solimoes, Igarape Belem), Brazil.

DISTRIBUTION: Known only from the type collection.

Brazil: Amazonas: basin of Rio Solimoes (terra-firma), *Froes 12059* (NY, type).

In vegetative characters this species resembles *S. mattogrossensis, S. nigricans* and *S. malacosperma*. In *S. Schultesiana* fruits are about 4.5 cm in diam., shells about 1 mm thick, and seeds many per fruit. As per Ducke (33: 85, 86) in *S. mattogrossensis* fruits are 1–2 cm in diam., shells 0.5–0.8 mm thick, and seeds one or few per fruit; in *S. nigricans* fruits are 3–5 cm in diam., shells 4–8 mm thick and seeds 5 to 11 per fruit, whereas in *S. malacosperma* fruits are 5–10 cm in diam., shells 3–5 mm thick, and seeds 20–25 per fruit.

In the systematic arrangement of the species, in the absence of flowers, I am placing this species tentatively between *S. mattogrossensis* and *S. malacosperma* to which it bears a general resemblance in many respects.

Tendrils are not present on the specimens examined. According to the collector the plant is a vine provided with spines. Fruits were collected in the type locality in June. The collection of flowers and of a carefully selected series of leaves from various parts of mature plants (also of young plants) would be of considerable interest.

This species is named in honor of Dr. Richard E. Schultes who, over a period of several years, has made rather extensive collections of *Strychnos* in Amazonian Colombia.

59. Strychnos malacosperma Ducke & Froes, Bol. Técn. Inst. Agron. Norte **30**: 43. 1955.

Illustration: Bol. Técn. Inst. Agron. Norte **30**: fig. 1–8. 1955.

Type locality: Para: basin of Rio Amazonas (near Monte Alegre, Colônia de Mulata), Brazil.

Brazil: Para: basin of Rio Amazonas, *Froes 30600* (Jan. 1953; in fruit), *30600* (Dec. 19, 1953; in flower; *type coll.*).

I have not seen Dardano A. Lima's collection (Apr. 1953; in fruit) from the same locality as the type collection and referred to by Ducke (31: 44).

It is unfortunate that the authors do not indicate in the original description as to which is the type collection. Furthermore specimens in fruit collected in Jan. 1953, and said to be from the same plant, bear the same collector's number (*Froes 30600*) as the specimen in flower collected on Dec. 19, 1953 which obviously should be considered as the type collection.

In flower characters this species is close to *S. longisepala*, to which it is related, and it differs from the latter only by the inflorescences. In vegetative characters it resembles *S. mattogrossensis*, *S. nigricans* and *S. Schultesiana*. For the characters by which it can be distinguished from these three species on the basis of fruits see under *S. Schultesiana*. For the description of its fruits see (31: 43; 33: 86).

This species is provided with spines and tendrils and it abounds in patches of forests in savannas.

60. Strychnos oiapocensis Froes, Bol. Técn. Inst. Agron. Norte **36**: 153 (Dec.) 1959.

Strychnos oyapocensis Froes "n. sp. ined." ex Ducke, Bul. Técn. Inst. Agron. Norte **30**: 41, nomen subnudum. 1955.

Strychnos oiapacensis Froes, in Curare and Curare-like agents, edited by D. Bovet, F. Bovet-Nitti and G. B. Marini-Bettolo. Pp. 85, 90, 108, nomen nudum. 1959.

It is unfortunate that before this species was published properly a nomen subnudum and a nomen nudum appeared in print and the former name was cited in the Index Kewensis. It is to be noted that Ducke's spelling of the specific name is different from that of Froes and he probably is in error citing *Froes 26711* as the basis for the name, especially as he himself states that this species (at least in 1955) was known only from a single individual plant.

In the systematic arrangement I am placing this species together with *S. Poeppigii* and *S. longisepala* largely on the basis of its inflorescences (small, congested and in spherical clusters) from which it differs however in longer pedicels and much shorter calyx-lobes. Leaves of this species resemble those of *S. acuta* of southern Brazil but do not resemble leaves of any species of *Breviflorae* found in the basin of the Amazon River.

Type locality: Territory of Amapa (basin of Rio Oiapoque, between waterfalls Grande Roche and Matabú).

Illustration: Bol. Técn. Agron. Norte **36**: pl. 3, fig. A–C. 1959.

Distribution: Known only from the basin of Rio Oiapoque, Territory of Amapa, Brazil. Doubtless occurs also in French Guiana.

Brazil: Territory of Amapa, *Froes 26719* (NY, type coll.), *Irwin, Pires & Westra 48890.*

The plant is an erect shrub becoming scandent above, devoid of spines and tendrils, at least on the specimens examined and confined to terra-firme. Specimens in flower were collected in October.

Fruits of this species are still unknown. It would be important to collect and describe mature fruits and seeds and place this species in the proper place in the key made by Ducke, which is based on fruit characters (31: 53–57).

61. **Strychnos Poeppigii** Prog.

This species is known only from four collections. Two collections are from Amazonian Peru (of which one is from Loreto, basin of Rio Huallaga) and two collections, from Amazonian Brazil (of which one is from the basin of the upper Rio Solimoes in the State of Amazonas). I have not seen *J. Huber herb. Mus. Para 4368* from Porto Alegre, basin of the upper Rio Purus, State of Amazonas, Brazil, which Ducke places with this species. (31: 47). Doubtless occurs also in adjacent Colombia and Peru.

In Ducke's key made on the basis of fruit characters, this species comes together with *S. mattogrossensis, S. longisepala,* and *S. tarapotensis* (33: 86).

62. **Strychnos longisepala** Krukoff

Peru: San Martin (Sapasoa, alt. 400 m), *Woytkowski 5452* (M).
This is the first record of the species from San Martin.

DISTRIBUTION: Peru (Loreto, basins of Rio Marañon, Rio Ucayali and of Rio Nanay and San Martin) and Brazil (in the State of Para it has been collected near Rio Branco de Obidos and in the basin of the lower Rio Trombetas; in the State of Amazonas, in the basin of the lower and upper Rio Solimoes and of the middle Rio Jurua, as well as in the Territory of Acre, in the basin of Rio Acre). Doubtless occurs also in adjacent Colombia and Bolivia.

LOCAL NAMES: Limon-casha (San Martin, Peru).

Ducke (33: 81) suggests that *S. longisepala* is merely a form of *S. Poeppigii* and he makes special reference to a specimen collected on April 6, 1904 by Huber in the basin of Rio Purus (Ponte Alegre) which, according to him, has rather long calyx-lobes (as in *S. longisepala*) but was identified by me as *S. Poeppigii.* Before accepting or rejecting Ducke's suggestion concerning *S. longisepala,* I would like to examine the specimens on which he based this suggestion. Four specimens of *S. Poeppigii* and 14 specimens of *S. longisepala* are cited in our papers and I cannot understand how we overlooked citing the above referred to specimen collected by Huber if it was annotated by us.

For information on its position in Ducke's key made on the basis of fruit characters, see under *S. Poeppigii* (33: 86).

63. **Strychnos tarapotensis** Sprague & Sandw.

DISTRIBUTION: Peru (Loreto, basin of Rio Marañon, and San Martin, basin of Rio Huallaga, where it is common); Brazil (Amazonas, basin of the middle Rio Jurua, and Territory of Acre, basin of the upper Rio Purus). Sterile specimen (*Killip, Dugand & Jaramillo 39309*) has been placed by us with this species with reservation. It has been collected in Colombia, Cundinamarca (between Tocaima and Pubenza). Doubtless occurs also in Bolivia in the region adjacent to the Territory of Acre. I have not seen any specimens from the basin of Rio Acre to which Ducke refers in his paper (31: 48).

For information on its position in Ducke's key made on the basis of fruit characters, see under *S. Poepigii.*

64. Strychnos brasiliensis (Spreng.) Mart.

Brazil: *J .G. Kuhlmann 1582.* Minas Gerais: *Irwin 2201* (US). Rio de Janeiro: *Brade 16806* (M) (Serra dos Orgâos, 1000 m), *Góes & Constantino 747* (M), *Luiz Emygdio de Mello 1270* (US). São Paulo: *Segadas Vienna 2714, Pickel 5453* (US). Parana (elev. 1120 m), *Hatschbach 14323* (F). Santa Catarina: *Hatschbach 1118* (US), *Klein 822* (US), *1273, 1427, Reitz & Klein 4392, 4683, 5653* (US), *7333* (US), *L. B. Smith & Reitz 8807* (US), *L. B. Smith & Klein 8505* (US) (alt. 1000–1300 m, lower slopes of Morro Iquarerim), *8212, 11804* (US, M), *11890* (US), *Reitz & Klein 4392, 4683.* Rio Grande do Sul: *Palacios-Cuezzo 930* (M), *Rambo 29261* (M), *38722* (F, W), *49491* (M). Paraguay: *Hassler 7464* (W), *Woolston 1134* (US). Argentina: Misiones: *Curran 45* (US), *Edmundo Gesmero s.n.* (*Herb. Inst. Mig. Lillo 98633*) (US), *Montes 2189* (GH), *Schulz 7021* (W), *Schwarz 3739* (US, W), *4426* (US, W), *Schwindt 695* (W). Corrientes: *Burkart 19718* (US), *Cabrera 11918* (US), *Harrola 1479* (W), *Paderson 2912.* Bolivia: Sta Cruz (Cerro de Amboró, elev. 1000 m), *Steinbach s.n.* (*Herb. Inst. Mig. Lillo 58873*) (GH).

This is the first record of the species from Bolivia.

DISTRIBUTION: Brazil (Minas Gerais, Rio de Janeiro, São Paulo, Parana, Sta Catarina, Rio Grande do Sul); Paraguay, Argentina (Misiones, Corrientes), and Bolivia (Santa Cruz).

This species is one of the very few of the genus which is confined to the subtropics. The highest elevation of 1500–2000 m is recorded for it in Campos do Jordão, São Paulo (*J. Eugenio Leite 3594*). The species is one of the most frequently collected species, the others being *S. guianensis* and *S. Mitscherlichii.*

It is very satisfying that no nomenclatural changes were made in this complex since we revised the American species. I am in complete agreement with Ducke that it is best studied on the basis of the cultivated plants grown from seeds collected from various regions of its extensive range.

According to Ducke (31: 49, 54), fruits and seeds permit an easy and conclusive identification of this species. His description is quoted below: "Testa cartilagenous, very thin, entirely glabrous. Seeds 1, perfectly globose (or, seldom, 2 semiglobose). Fruits very small (diameter 10–20 mm.); the young ones, obovoid; the adult, globose or subglobose with obtuse or narrowed base, red or orangish red, smooth, shining, shell very thin, more fleshy than papery." Its fruits and seeds are very similar to those of the West Indian *S. Grayi.*

For information on the tests of crude extracts of this species on curare-like action, see under *S. trinervis.*

DOUBTFUL SPECIES

Of the nine doubtful species listed in one monograph (1: 321), *S. albiflora* was reinstated as a valid species once the type collection became available, *S. cobalongo* was excluded from the genus, and *S. Bredemeyeri* was placed with doubts in the synonymy of *S. pedunculata.*

The identities of three species described by Barbosa Rodriguez on sterile material (*S. kauichana, S. lethalis* and *S. tonantinensis*), as well as one species described by Planchon (*S. yapurensis*), likely will remain in doubt, as apparently the type collections of these were lost.

It may be possible as yet to ascertain the identities of two other species, which I will discuss below:

1. *Strychnos Gubleri* G. Planch. Comp. Rend. Acad. Sci. Paris, **88**: 134, hyponym. 1880; Jour. de Pharm. V. **1**: 196. 1880.

Strychnos Gubleriana G. Planch; Baillon, Bot. Med. 1219. 1884.

This species is based on a sterile specimen collected in the basin of the upper Orinoco in Venezuela. It is reported as the *main* component of curare of the Maquiritaras and Piaroas. As per Dr. H. Pittier, at least in 1942, curare still was prepared by the Maquiritare Indians residing in the Caura Valley. Specimens of a *Strychnos* collected in the Caura Valley and reported by the Maquiritare Indians as the main component of their curare may elucidate as to what this species is.

2. *Lasiostoma stans* Willd.; Schult. Mant. Syst. **3**: 64. 1827.

Rouhamon stans DC. Prodr. **9**: 18. 1845.

This species is based on a specimen from Brazil and it may well be that the type is available in Willdenow herbarium.

APPENDICES

In **Appendix** I are listed species as they are presently recognized by me; also species which were described as new, and/or reinstated as valid and/or reduced to synonymy, and/or transferred from synonymy of one species to synonymy of another species, since our monograph appeared in print in 1942. This list will be helpful to a future monographer of the genus and in identification of specimens.

In **Appendix** II species are grouped under the authors of the species.

In **Appendix** III species are grouped under the collectors of the type specimens.

In **Appendix** IV species are grouped under the countries of origin of the type specimens.

In **Appendix** V are listed species which were studied chemically since the early thirties. This list will be helpful to the collectors and should stimulate the collection of authentic samples of species of *Strychnos,* for chemical and pharmacological studies. It is hoped that the collectors will collect root bark, also the bark of stems from the lower part of the plants (as well as seeds, if such are available). The bark of the upper part of the plants is usually poor in alkaloids. If such samples are well dried in the sun, then the chemists will have a good chance of ascertaining as to what alkaloids are found in a given species.

More detailed information on the alkaloids which were isolated to date from various species of *Strychnos,* is given under each species. This information is fairly well complete as I have examined practically all papers published since the early thirties, which deal with chemical and pharmacological studies of American species of *Strychnos* (not papers dealing with various curares). It should be noted that such summaries are already available in papers by Karrer et al. (92) and by Marini-Bettolo et al. (108: 268, 269).

However, in this paper an effort was made to trace, as far as possible, the real identity and the origin of the samples on which chemical and/or pharmacological work was done.

In **Appendix** VI is given statistical data on the specimens which were examined and cited in our monograph and its supplements. These data give information at a glance as to the poorly collected species and of which further collections are of considerable interest, as well as of the species which in the absence of a carefully selected series of specimens from various parts of mature and young plants, are difficult to identify on the basis of sterile material. This may be fairly well judged in some cases by the number of the specimens identified with doubts. From the statistical data given in this Appendix I now estimate that probably approximately 2300 collections were made of the American species of *Strychnos* to date. I arrive at this figure by the following calculations: 1957 collections from 28 principal herbaria were examined, annotated and cited in our papers and I estimate that probably approximately 343 additional collections are available in various herbaria (largely collections of Froes made since 1950 and deposited with Instituto Agronomico do Norte, Belem and which are not represented by duplicates in other herbaria already seen by me; also specimens in 17 herbaria which were accumulated since 1948 and which were not seen by me in 1963/4, also specimens from Berlin Botan. Museum, and Munchen Botan. Staatssammlung which I never had on loan).

Statistical data, as given here, do not check with the totals of specimens originally cited in the monograph and its supplements. Some of the identifications were changed and in such cases these specimens appear in the totals of the papers where the identifications were changed. All specimens of *S. nigricans* and S. *mattogrossensis* are shown as cited in the 7th suppl. where a new concept of these two species was discussed.

In **Appendix** VII are given changes in the identifications of specimens.

APPENDIX I

List of Known Species of *Strychnos*

I. *Longiflorae*

1. *chlorantha*
2. *ramentifera*
3. *colombiensis* (described in 7th suppl.)
4. *asperula*
5. *rondeletioides*
6. *macrophylla* (reinstated in 1st suppl.; 2:21)
7. *Barnhartiana*
8. *brachiata*
9. *Blackii* (reviewed in 7th suppl.)
10. *trinervis*
11. *panamensis*
12. *tabascana*
13. *divaricans*
14. *eugeniaefolia* (reviewed in 7th suppl.)
15. *Krukoffiana* (reviewed in 5th suppl.; 6:11)
16. *medeola*
17. *toxifera*
18. *tomentosa*
19. *diaboli*
20. *javariensis*
21. *Jobertiana*
22. *pseudo-quina*
23. *xinguensis*
24. *amazonica*
25. *solimoesana*
26. *Froesii* (reviewed in 7th suppl.)
27. *lobeliodes* (described in 7th suppl.)
28. *Peckii*
29. *Smithiana*
30. *Erichsonii*
31. *Gardneri*
32. *pubiflora*
33. *pedunculata*
34. *Mitscherlichii*

34a. *Mitscherlichii* var. *pubescentior*

35. *darienensis*

II. *Intermediae*

36. *guianensis*
37. *glabra* (reinstated in 3rd suppl.; 5:345)
38. *subcordata*
39. *bicolor*
40. *panurensis*
41. *Duckei* (described in 2nd suppl.; 3:68)
42. *hirsuta*
43. *cogens*
44. *Melinoniana*

III. *Breviflorae*

45. *parviflora*
46. *Bovetiana* (reviewed in 7th suppl.)
47. *Castelnaeana*
48. *rubiginosa*
49. *Fendleri*
50. *Torresiana* (described in 3rd suppl.; 4:348)
51. *acuta*
52. *albiflora* (reinstated in 3rd suppl.; 4:349)
53. *parvifolia*
54. *Grayi*
55. *pachycarpa* (reviewed in 2nd suppl.; 3:70)
56. *nigricans*
57. *mattogrossensis* (reinstated in 7th suppl.)
58. *Schultesiana* (described in 7th suppl.)
59. *malacosperma* (reviewed in 7th suppl.)
60. *oiapocensis* (reviewed in 7th suppl.)
61. *Poeppigii*
62. *longisepala*
63. *tarapotensis*
64. *brasiliensis*

Species reduced to synonymy and/or transferred from a synonymy of one species to synonymy of another species, this since our monograph appeared in print in 1942.

S. brachistantha Stanly. was reduced to synonymy under *S. nigricans* (in 7th suppl.)

S. brasiliensis var. *rigida* Benth. was transferred from synonymy of *S. brasiliensis* to synonymy of *S. parvifolia* (4:348).

S. Bredemeyeri (Schult.) Sprague & Sandw. listed by us among doubtful species (1:321) was placed with reservation in synonymy under *S. pedunculata* (in 7th suppl.).

S. cobalongo Appun. listed by us among doubtful species (1:321) was excluded from the genus (2:24).

S. Crevauxiana Baill. was transferred from synonymy of *S. guianensis* to synonymy of *S. glabra* (4:345).

S. hachensis Karst. was reduced to synonymy under *S. panamensis* (6:15; in 7th suppl.)

S. marginata Benth. was transferred from synonymy of *S. brasiliensis* to synonymy of *S. parvifolia* (4:348).

S. Solerederi Gilg. was transferred from synonymy of *S. Melinoniana* to synonymy of *S. Mitscherlichii* (4:345).

APPENDIX II

Authors of the species

Baillon, H. — *Jobertiana, Melinoniana.*
Barbosa Rodrigues, J. — *macrophylla.*
Bentham, G. — *tomentosa, cogens.*
Bentham, G. (orig. described by De Candolle, Alph.) — *pedunculata.*
De Candolle, Alph. — *Gardneri.*
De Candolle, Aug. P. — *rubiginosa, parvifolia.*
Ducke, A. — *ramentifera, Blackii, divaricans, Krukoffiana, Froesii, pachycarpa.*
Ducke, A. & Froes, R. — *malacosperma.*
Froes, R. — *oiapocensis.*
Grisebach, A. H. R. — *Grayi.*
Krukoff, B. A. — *Barnhartiana, javariensis, xinguensis, amazonica, solimoesana, Smithiana, pubiflora, Schultesiana, longisepala.*
Krukoff, B. A. & Barneby, R. — *colombiensis, lobeliodes.*
Krukoff, B. A. & Monachino, J. — *Duckei, Torresiana.*
von Martius, K. F. P. (orig. described by Aublet, J. B. C. F.) — *guianensis.*
von Martius, K. F. P. (orig. described by Spreng, K. S.) — *brasiliensis.*
von Martius, K. F. P. (orig. described by Velloso, J. M.) — *trinervis.*
Monachino, J. — *eugeniaefolia.*
Moore, S. — *mattogrossensis.*
Pires, J. M. — *Bovetiana.*
Progel, A. — *chlorantha, bicolor, acuta, albiflora, nigricans, Poeppigii.*
Robinson, B. L. — *Peckii.*
Ruiz, H. & Pavon, J. — *brachiata.*
Sagot, P. A. — *medeola, glabra.*
de Saint Hilaire, A. — *pseudo-quina.*
Sandwith, N. Y. — *diaboli, Mitscherlichii* var. *pubescentior.*
Schomburgk, Rich. — *Erichsonii, Mitscherlichii.*
Schomburgk, Rob. — *toxifera.*
Seemann, B. — *panamensis, darienensis.*
Sprague, T. A. & Sandwith, N. Y. — *asperula, tabascana, panurensis, Fendleri, tarapotensis.*
Spruce, R. — *rondeletioides, subcordata, hirsuta, parviflora.*
Weddel, H. A. — *Castelnaeana.*

APPENDIX III

Collectors of the type specimens

Aublet, J. B. C. F. — *guianensis.*
Bach, J. — *xinguensis.*
Barbosa Rodrigues, J. — *macrophylla.*
Black, G. A. — *Blackii.*
Blanchet, J. S. — *rubiginosa, parvifolia.*
de Castelnau, F. — *Castelnaeana.*

Cuatrecasas, J. — *colombiensis.*
Ducke, A. — *ramentifera, Barnhartiana, divaricans, Krukoffiana, Duckei, pachycarpa.*
Fendler, A. — *Fendleri.*
Froes, R. — *eugeniaefolia, Froesii, Schultesiana, malacosperma, oiapocensis.*
Gaudichaud, Ch. — *acuta.*
Gardner, G. — *Gardneri.*
Hoffman, C. — *chlorantha.*
Jobert, C. — *Jobertiana.*
Krukoff, B. A. — *javariensis, solimoesana, Smithiana, Mitscherlichii* var. *pubescentior.*
Lund, P. W. — *bicolor.*
Luschnath, B. — *albiflora.*
Melinon, M. — *Melinoniana.*
de Mello Barreto, H. L. — *pubiflora.*
de Mello Filho, L. E. et al. — *Torresiana.*
Moore, S. — *mattogrossensis.*
Peck, Ch. H. — *Peckii.*
Pires, J. M. — *Bovetiana.*
Poeppig, E. F. — *Poeppigii.*
Rovirosa, J. N — *tabascana.*
Ruiz, H. & Pavon, J. — *brachiata.*
Sagot, P. A. — *medeola, glabra.*
de Saint Hilaire, A. — *pseudo-quina.*
Sandwith, N. Y. — *diaboli.*
Schomburgk, Rich. — *tomentosa.*
Schomburgk, Rob. — *toxifera, Erichsonii, pedunculata, Mitscherlichii, cogens.*
Schott, H. W. — *nigricans.*
Schultes, R. E. & Cabrera, I. — *lobelioides.*
Schunke, J. M. — *amazonica.*
Seemann, B. — *panamensis, darienensis.*
Sellow, F. — *brasiliensis.*
Spruce, R. — *rondeletioides, subcordata, panurensis, hirsuta, parviflora, tarapotensis.*
Ule, E. H. G. — *asperula.*
Velloso, J. M. — *trinervis.*
Williams, S. — *longisepala.*
Wright, C. — *Grayi*

APPENDIX IV

Countries of origin of the type specimens

Cuba: *Grayi.*
Mexico: *tabascana.*
British Honduras: *Peckii.*
Costa Rica: *chlorantha.*
Panama: *panamensis, darienensis.*
Venezuela: *Fendleri.*
British Guiana: *toxifera, tomentosa, diaboli, Erichsonii, pedunculata, Mitscherlichii, cogens.*
Colombia: *colombiensis, lobelioides.*
French Guiana: *medeola, guianensis, glabra, Melinoniana.*
Peru: *brachiata, amazonica, Castelnaeana, Poeppigii, longisepala, tarapotensis.*
Brazil: Territory of Amapa: *eugeniaefolia, oiapocensis.*
Para: *ramentifera, Blackii, divaricans, xinguensis, Bovetiana, malacosperma.*
Amazonas: *rondeletioides, macrophylla, Barnhartiana, Krukoffiana, javariensis, Jobertiana, solimoesana, Froesii, Smithiana, Mitscherlichii* var. *pubescentior, subcordata, panurensis, Duckei, hirsuta, parviflora, pachycarpa, Schultesiana.*
Territory of Acre: *asperula.*
Matto Grosso: *mattogrossensis.*

Goias: *pseudo-quina, Gardneri.*
Bahia: *rubiginosa, parvifolia.*
Minas Gerais: *pubiflora.*
Espirito Santo: *Torresiana.*
Rio de Janeiro: *trinervis, acuta, albiflora, nigricans, brasiliensis.*
São Paulo: *bicolor.*

APPENDIX V

Species studied chemically (since the early thirties)

Longiflorae.

6. *macrophylla* — Marini-Bettolo et al.
10. *trinervis* — Marini-Bettolo et al.
13. *divaricans* — Marini-Bettolo et al.
17. *toxifera* — H. Wieland et al.; King; Folkers & Unna; Karrer, Schmid et al.; Battersby et al.
18. *tomentosa* — Marini-Bettolo et al.
19. *diaboli* — King; Schlittler et al.
20. *javariensis* — Folkers & Unna (alkaloids were not characterized).
21. *Jobertiana* — Folkers & Unna; Marini-Bettolo et al. (traces of alkaloids only, alkaloids were not characterized).
24. *amazonica* — Marini-Bettolo et al.
25. *solimoesana* — Berredo de Carneiro; Marini-Bettolo et al.
26. *Froesii* — Marini-Bettolo et al.
28. *Peckii* — Folkers & Unna (strong curare activity in total extract of root bark, none—in stem bark); Marini-Bettolo et al. (traces of alkaloids only).
30. *Erichsonii* — King (alkaloids were not characterized; total extracts have no curare activity).
34. *Mitscherlichii* — King; Karrer, Schmid et al.; Marini-Bettolo et al.

Intermediae.

36. *guianensis* — King; Marini-Bettolo et al. (some samples of stem bark were free of alkaloids whereas the root bark of the same plant was found to be very rich in alkaloids).
37. *glabra* — King; Marini-Bettolo et al. (alkaloids were not characterized).
38. *subcordata* — Marini-Bettolo et al.
43. *cogens* — Marini-Bettolo et al. (traces of alkaloids only).
44. *Melinoniana* — King; Schlittler et al.; Karrer, Schmid et al. (alkaloids do not possess any curare activity).

Breviflorae.

47. *Castelnaeana* — Folkers & Unna (alkaloids were not characterized).
48. *rubiginosa* — Marini-Bettolo et al.
50. *Torresiana* — Marini-Bettolo et al. ("numerous alkaloids still under a study").
51. *acuta* — Marini-Bettolo et al. (total extracts have no curare activity).
53. *parvifolia* — Marini-Bettolo et al.
55. *pachycarpa* — Marini-Bettolo et al. (only tertiary bases).

APPENDIX VI

Specimens (Collections) Cited in the Monograph and its Supplements

	Monograph (9/42)	*Suppl. 1 (9/43)*	*Suppl. 2 (9/46)*	*Suppl. 3 (3/48)*	*Suppl. 4 (6/47)*	*Suppl. 5 (8/47)*	*Suppl. 6 (9/50)*	*Sub-Total*	*Suppl. 7*	*Total*
1. *chlorantha*	4	—	—	—	—	—	—	4	4	8
2. *ramentifera*	1	—	1	1	1	2	1	7	2	9
3. *colombiensis*	—	—	—	—	—	—	—	—	1	1
4. *asperula*	1	—	—	—	—	1	—	2	—	2
5. *rondeletioides* (2 with doubts)	16	5	3	—	11	3	21	59	14	73
6. *macrophylla*	—	1	1	—	2	—	1	5	5	10
7. *Barnhartiana*	6	—	2	—	4	1	—	13	1	14
8. *brachiata* (2 with doubts)	7	—	—	1	1	1	—	10	—	10
9. *Blackii*	—	—	—	—	—	—	—	—	4	4
10. *trinervis*	13	3	23	19	3	2	7	70	9	79
11. *panamensis* (1 with doubts)	72	4	1	3	3	—	1	84	24	108
12. *tabascana*	32	8	—	—	—	—	—	40	7	47
13. *divaricans* (2 with doubts)	1	—	—	—	2	—	1	4	1	5
14. *eugeniaefolia*	—	—	—	—	—	—	—	—	1	1
15. *Krukoffiana*	—	—	—	—	—	1	—	1	1	2
16. *medeola*	4	—	4	4	—	—	2	14	4	18
17. *toxifera*	26	—	—	1	5	2	5	39	3	42
18. *tomentosa*	4	—	1	—	4	1	5	15	16	31
19. *diaboli*	6	—	—	—	4	2	—	12	1	13
20. *javariensis*	7	—	1	—	—	5	3	16	—	16
21. *Jobertiana*	23	2	3	2	6	3	9	48	13	61
22. *pseudo-quina*	22	—	15	6	—	—	2	45	10	55
23. *xinguensis*	1	—	—	—	—	—	—	1	—	1
24. *amazonica* (2 with doubts)	7	1	2	—	2	6	1	19	2	21
25. *solimoesana* (1 with doubts)	7	—	—	—	1	—	1	9	1	10
26. *Froesii*	—	—	—	—	—	—	—	—	9	9
27. *lobelioides*	—	—	—	—	—	—	—	—	1	1
28. *Peckii*	43	6	5	1	12	5	16	88	12	100
29. *Smithiana*	4	—	—	—	—	—	—	4	—	4
30. *Erichsonii*	30	—	2	6	18	2	12	70	39	109
31. *Gardneri* (1 with doubts)	8	1	3	6	—	—	3	21	2	23
32. *pubiflora*	1	—	—	—	—	—	—	1	—	1
33. *pedunculata*	6	—	—	—	—	—	—	6	4	10
34. *Mitscherlichii*	56	4	8	3	15	—	5	91	28	119
34a. *Mitscherlichii* (var. *pubescentior*)	8	—	—	2	6	—	—	16	4	20
35. *darienensis* (6 with doubts)	18	2	1	4	4	3	1	33	13	46
36. *guianensis*	87	11	14	6	13	—	17	148	47	195
37. *glabra*	10	1	—	6	12	—	2	31	4	35
38. *subcordata*	12	1	4	1	3	—	2	23	8	31
39. *bicolor*	4	—	2	—	1	—	1	8	1	9
40. *panurensis*	7	1	2	1	1	4	3	19	13	32
41. *Duckei*	—	—	1	—	—	—	—	1	—	1
42. *hirsuta*	5	1	1	—	1	—	1	9	2	11
43. *cogens* (1 with doubts)	10	2	1	2	2	—	4	21	4	25

APPENDIX VI (cont'd)

Specimens (Collections) Cited in the Monograph and its Supplements

	Mono-graph (*9/42*)	*Suppl. 1* (*9/43*)	*Suppl. 2* (*9/46*)	*Suppl. 3* (*3/48*)	*Suppl. 4* (*6/47*)	*Suppl. 5* (*8/47*)	*Suppl. 6* (*9/50*)	*Sub-Total*	*Suppl. 7*	*Total*
44. *Melinoniana*	6	—	1	2	1	—	2	12	2	14
45. *parviflora*	14	5	—	—	4	3	1	27	—	27
46. *Bovetiana*	—	—	—	—	—	—	—	—	1	1
47. *Castelnaeana*	85	—	1	1	5	—	1	93	—	93
48. *rubiginosa* (15 with doubts)	7	1	3	1	—	—	9	21	3	24
49. *Fendleri*	4	2	—	1	2	—	—	9	7	16
50. *Torresiana*	—	—	—	2	—	—	2	4	2	6
51. *acuta* (1 with doubts)	2	—	—	2	1	—	—	5	1	6
52. *albiflora* (14 with doubts)	—	—	—	15	—	—	1	16	1	17
53. *parvifolia*	23	—	7	6	1	—	11	48	5	53
54. *Grayi*	17	—	4	—	—	—	—	21	3	24
55. *pachycarpa*	—	—	2	—	—	—	—	2	—	2
56. *nigricans*	—	—	—	—	—	—	—	—	41	41
57. *mattogrossensis*	—	—	—	—	—	—	—	—	48	48
58. *Schultesiana*	—	—	—	—	—	—	—	—	1	1
59. *malacosperma*	—	—	—	—	—	—	—	—	2	2
60. *oiapocensis*	—	—	—	—	—	—	—	—	2	2
61. *Poeppigii*	3	—	—	—	1	—	—	4	—	4
62. *longisepala* (2 with doubts)	5	1	—	4	—	2	1	13	1	14
63. *tarapotensis* (1 with doubts)	11	—	—	—	—	—	—	11	—	11
64. *brasiliensis*	36	1	36	15	4	—	11	103	40	143
Total (51 with doubts)	782	64	155	110	156	49	166	1482	475	1957

APPENDIX VII

Changes in the Identifications

	Cited originally as		*Cited later as*	
Froes 23515 (sterile from young plants)	? *toxifera*	(7:5)	*tomentosa*	(7th suppl.)
			"	"
Froes 23515a "	"	"	"	"
" 23384 "	"	"	"	"
" 23399 "	"	"	"	"
" 23473 "	"	"	"	"
" 23110 "	"	"	"	"
" 20342 "	*toxifera*	(5:7)	"	"
Ducke s.n. (Aug. 8, 1941) (sterile from young plant)	*javariensis*	(2:22)	*Froesii*	(7th suppl.)
Maguire & Fanshawe 22875 (in flower)	*pedunculata*	(3:66)	*Erichsonii*	(5:10)
" 22929 (in flower)	"	"	"	(7th suppl.)
Moore 574 (in fruit)	? *parviflora*	(1:307)	*Erichsonii*	"
Ducke 2032 (in flower)	*Mitscherlichii*	(6:14)	*Mitscherlichii* var. *pubescentior*	"
Froes 12059 (in fruit)	*nigricans*	(1:316)	*Schultesiana* (type coll.)	"

Notes

For the correct identification of seven *sterile* specimens from *young* plants from Para (basin of Rio Tocantins), Maranhão and Territory of Rio Branco as *S. tomentosa* (cited by us with doubts under *S. toxifera*) I am indebted to Ducke who compared them with young plants raised from seeds obtained from a bush-rope and identified as *S. tomentosa* on the basis of flowering material (31:23). For further details see under *S. tomentosa*.

Before *S. Froesii* was described and became known to me, Ducke's sterile specimen from a young plant of this species was wrongly placed by us with *S. javariensis*.

Two specimens in *flower*, through the obvious error of Monachino, who I well recall dissected the flowers, were wrongly placed by us under *S. pedunculata* and N. Y. Sandwith called my attention to the wrong identification of one of these specimens. These specimens are of *S. Erichsonii*.

We placed *Moore 574* (in fruit) with doubts under *S. parviflora*, but now that fruits of many species of *Strychnos* are better known to me, I am placing it with *S. Erichsonii*. This is an important specimen as it is the first record of this species from the State of Matto Grosso, Brazil.

Ducke 2032 is best placed with *S. Mitscherlichii* var. *pubescentior*, as suggested by Barneby.

On the re-examination of fruits of *Froes 12059* it became obvious that it is a new species.

It should be also noted that inasmuch as *S. brachistantha* was reduced to synonymy under *S. nigricans* in this paper, *all* specimens originally cited under *S. brachistantha* were renamed as *S. nigricans*, and inasmuch as *S. mattogrossensis* was reinstated, as a valid species, many specimens, largely from the basin of the Amazon, Venezuela and Colombia, originally cited under *S. nigricans*, were renamed as *S. mattogrossensis*.

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The Botany of the Guayana Highland—Part VI
BASSETT MAGUIRE AND COLLABORATORS 1

Studies in Mexican Compositae. I. Miscellaneous New Species
ARTHUR CRONQUIST 286

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THE BOTANY OF THE GUAYANA HIGHLAND—PART VI

BASSETT MAGUIRE AND COLLABORATORS

INTRODUCTION

This sixth issue of the series of reports on The Botany of the Guayana Highland quickly follows Part V which was released on 17 February 1964. Since that writing only one additional exploration [1] has been completed as noted below. At this immediate time Dr. Julian Steyermark and Sr. Felix Cardona, on behalf of the Servicio Botanico of Caracas and The New York Botanical Garden, are conducting a further exploration of the lofty Auyan-tepui of the Gran Sabana in Estado Bolivar, Venezuela. Auyan-tepui is one of the widely known ''Lost World's'' of Guayana, because it gives rise to the spectacular Angel Falls, dropping sheer for more than a half mile, and believed to be the highest large waterfall known.

1. Upper Río Cuyuni, including its two headwater branches the Río Uirí and Río Chicanán, 13 August 1962–13 September 1962, Bassett Maguire, Julian A. Steyermark and Celia K. Maguire; nos. 46713–46999; 53500–53888.

Since our work carried us from Eldorado, at barely 100 m altitude, to the sandstone summit of Cerro Uirí at northern escarpment of the Gran Sabana at some 1000 m elevation, the transitional transect from Guianan riverine forest, to Guayanan sandstone escarpment and plateau forest produced much instructive information and many critical records. It had been indicated by our earlier work on the eastern margins of the Pakaraimas in British Guiana that this is a region of much active floristic differentiation. This most recent field study on the northern margin of the Gran Sabana, reinforces the evidence that the peripheral environments have given rise to considerable evolutionary activity in the segregation of discrete specific populations.

Reported on in Part VI of ''The Botany of the Guayana Highland'' are: *Gramineae* by Thomas R. Soderstrom; *Cyperaceae, Lagenocarpeae* by Tetsuo Koyama and Bassett Maguire; *Scleria* by Earl L. Core; *Stegolepis, Epidryos* and *Rapatea* of the *Rapateaceae* by Bassett Maguire; *Lauraceae* by Caroline K. Allen; *Ilex* by Gabriel Edwin; *Euphorbiaceae* by Eugene Jablonski and *Rubiaceae* by Julian A. Steyermark.

It may be assumed that specimens collected on the Guayana expeditions are deposited at The New York Botanical Garden, the National Herbarium of Venezuela and the U. S. National Herbarium.

GRAMINEAE [2]

During February and March of 1962, the author was a member of a Smithsonian Institution Expedition to Kaieteur Plateau, Essequibo District, British Guiana. This plateau, situated approximately 160 miles south of the northern coast of South America, has an elevation of about 1400 feet and is part of the Pakaraima Series of sandstone ridges which extend from Venezuela and Brazil into British Guiana. Extensive collections of the grass flora both on the plateau and in the Potaro River Gorge near the splash-basin of Kaieteur Fall yielded five previously undescribed species. In addition to these, a sixth species is described from an earlier collection of Maguire and Fanshawe made at Maipuri Falls, Essequibo District.

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[1] The National Science Foundation has, in large part, financed the expedition described above, and the study of materials herein reported.

[2] By Thomas R. Soderstrom, Department of Botany, Smithsonian Institution.

Panicum savannarum Soderstrom, sp. nov.

Planta perennis; culmi glabri, ca. 0.5 m alti, erecti, rhizomatosi; nodi ramosi; vaginae glabrae, quam internodi longiores, truncatae; ligula ca. 0.5 mm longa, membranacea, glabra, appressa; laminae ca. 8–12 cm longae, 1–1.5 cm latae, glabrae, rigidae, oblongo-lanceolatae, basi quam vaginae angustiores; panicula usque ad 12 cm longa, 12 cm lata, ramis flexuosis, implicatis, rigidis; spiculae globosae vel ovatae, glabrae, 1.8–2 mm longae; gluma prima triangulata, 3-nervia, 1/2–4/5 spiculae aequans; gluma secunda quam lemma sterile paulo brevior, glabra, obtusa, 5-nervia; lemma sterile lemma fertilem aequans, glabrum, obtusum, 5-nervium; lemma fertile ca. 1.6 mm longum, glabrum, apiculatum.

Perennial; culms glabrous, about 0.5 m tall, stiffly erect from a rhizomatous base, branching at many of the nodes; sheaths glabrous, longer than the internodes, truncate at the summit, those at the base of the culm bladeless or with reduced blades, at the very base scale-like and investing the culms and rhizomes; ligule a short appressed glabrous membrane about 0.5 mm long; blades glabrous, stiff, strongly nerved, oblong-lanceolate, twisted and somewhat cordate at the base and narrower than the sheath at the point of attachment, those of the mid-culm about 8–12 cm long, 1–1.5 cm wide; panicles just exserted from the uppermost sheath, to 12 cm long, about as broad, densely flowered, the glabrous branches flexuous, implicate, stiff, the pedicels of the lateral spikelets 0.5–2.5 mm long; spikelets globose or oval, glabrous, 1.8–2 mm long; first glume triangular, 1/2–4/5 as long as the spikelet, 3-nerved; second glume a little shorter than the fertile lemma, glabrous, obtuse, 5-nerved; sterile lemma just covering the fertile lemma, glabrous, obtuse, 5-nerved; fertile lemma about 1.6 mm long, glabrous, somewhat apiculate.

BRITISH GUIANA. Essequibo District: Kaieteur Plateau, common rhizomatous perennial in sandy soil of Airstrip Savanna in full sun, vicinity of Kaieteur Fall and along western rim of Potaro Gorge, alt. ca. 1400 ft, leaf blades bluish-green, flat, 16 Mar 1962, *R. S. Cowan & T. R. Soderstrom 2195* (holotype, US No. 2380410; isotypes, GH, K, NY). Paratypes. Kaieteur Savanna, in dry thickets on sand, alt. about 1200 ft, glaucous, subscandent when able, leaves stiff, distichous, 4 Sep 1937, *N. Y. Sandwith 1361* (NY, US); Paramakatoi Savanna, alt. 2500 ft, in the open on sandy soil, May 1926, *Altson 506* (US); Upper Mazaruni River, Imbaimadai Savannas, alt. 550 m, becoming locally subdominant in savanna near Resthouse, perennial glaucous herb, 23 Oct 1951, *Bassett Maguire & D. B. Fanshawe 32203* (NY, US). BRAZIL. Terr. do Rio Branco: Serra Tepequem, common in wet savanna below airstrip, alt. 700–800 m, perennial bunch grass, 2 Dec 1954, *Bassett Maguire & Celia K. Maguire 40130* (NY, US). VENEZUELA. Bolívar: Ilu-Tepuí, Gran Sabana, frequent in moist sandy places in savanna at Kavanayen, alt. 1200 m, 30 Mar 1952, *Bassett Maguire 33694* (NY, US); Gran Sabana, between Kun and Uaduara-parú, in valley of Río Kukenán, south of Mount Roraima, alt. 1065–1220 m, 1 Oct 1944, *Julian A. Steyermark*

59077 (US); Sabanas de Urimán, en las orillas del río Caroní, Guayana, alt. 400 m, 18 Sep 1946, *F. Cardona 1615* (US). Large savanna, vicinity of Urimán, alt. 300 m, 30 Apr 1953, *Julian A. Steyermark 75258* (NY).

Many of the specimens cited as paratypes were referred previously to *Panicum nervosum* Lam., a species of the *Parvifolia* group of *Panicum*, of which this is likewise a member. A number of features which distinguish *P. savannarum* from *P. nervosum* are:

1. Plants caespitose; blades the same width as the sheaths at point of attachment, more or less cordate-clasping at the base; foliage pubescent or ciliate, especially on the margins near the ligule. *P. nervosum.*
1. Plants rhizomatous; blades narrower than the sheaths at point of attachment, not cordate-clasping at the base; foliage glabrous. *P. savannarum.*

The spikelets of the two species are similar, but in other respects they are quite distinct. The rhizomatous habit is not found in *P. nervosum* but is characteristic of *P. savannarum*. In the former the blade and sheath are more or less continuous without a noticeable demarcation between the two, but in the latter the blade is narrowed at the base where it is attached to the much wider summit of the sheath. The foliage of *P. savannarum* is glabrous throughout, but that of *P. nervosum* exhibits varying degrees of pubescence, especially on the upper margins of the sheaths, lower margins of the blades, and in the ligular region where it is prominent.

Paspalum bifidifolium Soderstrom, sp. nov.

Planta perennis, basilaris quasi-rhizomatosa; culmi erecti vel ascendentes, 15–30 cm alti, compressi, glabri; vaginae quam internodi longiores, compressae, inferiores basi sparse ciliatae, superiores glabrae; ligula 0.4–0.6 mm longa, fusca, glabra, membranacea; laminae planae utrinque glabrae, 5–10 cm longae, 6–10 mm latae, apice bifidae; racemi 2, 2.5–4 cm longi, ab axe glabro 3–5 mm longe separati; rachis ca. 0.5 mm lata; spiculae solitariae, 2.2–2.3 mm longae, 1.5 mm latae, ovatae, ellipticae vel obovatae, interdum apice acutae, glabrae; gluma et lemma sterile 5-nervia; lemma fertile 2 mm longum, ovatum, glabrum, minute striatum.

Perennial with a rhizomelike base, forming small sods, the rhizomes clothed with the persistent bases of old sheaths; culms erect or ascending, 15–30 cm tall, compressed, glabrous; sheaths overlapping, longer than the internodes, compressed, the lower ones sparsely ciliate at the base, the upper ones glabrous; ligule a short brown, glabrous, membranous rim 0.4–0.6 mm long; blades flat, glabrous on both surfaces, tapering at both ends and cleft at the apex, the cleft as much as 6 mm or more long, blades of the midculm 5–10 cm long, 6–10 mm wide, smaller upward; racemes 2, 2.5–4 cm long, approximate, ascending, separated by a glabrous axis 3–5 mm long, exserted only slightly from the uppermost bladeless sheath; rachis narrow, about 0.5 mm wide; spikelets solitary, 2.2–2.3 mm long, 1.5 mm wide, glabrous, ovate, elliptic, or obovate, the tip sometimes acute; glume and sterile lemma 5-nerved, the lateral pairs of nerves approximate; fertile lemma 2 mm long, oval, glabrous, minutely striate, shining.

BRITISH GUIANA. Essequibo District: Kaieteur Plateau, bottom of Potaro Gorge near Kaieteur Fall to western rim of splash-basin of Fall, alt. about 700 ft, common rhizomatous clumps among grasses and mosses on wet rocks in full sun, leaf blades flat, 13 Mar 1962, *R. S. Cowan & T. R. Soderstrom 2167* (holotype, US No. 2380409; isotypes, GH, K, NY, P).

The specific epithet refers to the peculiar nature of the blades, almost all of which are bifid at the apex. This character alone separates the species from others in *Paspalum,* although blades with bifid apices do occur in some species of the closely related genus *Axonopus.* The rhizomatous habit and the approximate spreading racemes are characteristics of species of *Paspalum* in the *Notata* section in which the closest ally is apparently *P. minus* Fourn. The racemes of *P. bifidifolium* are separated from each other by a short axis, whereas those of *P. minus* are conjugate or subconjugate. The major differences between the two species are summarized in the following key:

1. Blades narrow with parallel margins (to 6 mm wide), acute at the apex, more or less ciliate on the edges; ligule glabrous, but with a rim of hairs behind it; racemes conjugate or subconjugate. *P. minus.*
1. Blades widened at the middle (to 10 mm wide), bifid at the apex, mostly glabrous; ligule glabrous, without a rim of hairs behind it; racemes not conjugate, separated by a short axis. *P. bifidifolium.*

Thrasya achlysophila Soderstrom, sp. nov.

Planta perennis; culmi erecti vel ascendentes, usque ad 25 cm longi, glabri, multo-ramosi; vaginae compressae, carinatae, quam internodi longiores, margine pilosae vel papilloso-pilosae; ligula ca. 1.5 mm longa, fusca, erosa, membranacea, glabra; laminae planae, 3–8 cm longae, 5–8 mm latae, lanceolatae, utrinque dense papilloso-pilosae; racemi terminales et axillares, 2–3 cm longi; rachis 1.1–1.3 mm lata; spiculae 2.4–2.6 mm longae, glabrae; gluma prima 0.4–0.5 mm longa; gluma secunda ca. 3/4–4/5 spiculae aequans, obtusa, 7-nervia; lemma sterile lemma fertilem aequans, 5-nervium, sulcatum; palea sterile minuta vel deficens; lemma fertile 2.4 mm longum, ovatum, striatum; palea fertilis ovata, striata, marginibus involutis.

Perennial; culms tufted, erect or ascending, up to 25 cm long, glabrous, branching at most of the nodes; sheaths compressed-keeled, longer than the internodes, pilose or papillose-pilose along the margins, otherwise glabrous; ligule about 1.5 mm long, brown, erose, membranous, glabrous; blades flat, 3–8 cm long, 5–8 mm wide, lanceolate, narrowed at both ends, densely papillose-pilose over the entire upper and lower surfaces with hairs up to 4 mm long; racemes terminal and axillary, 2–3 cm long, on long slender peduncles, the rachis winged, 1.1–1.3 mm wide; spikelets 2.4–2.6 mm long, glabrous; first glume minute, 0.4–0.5 mm long; second glume about 3/4–4/5 as long as the spikelet, obtuse, 7-nerved; sterile lemma just covering the fertile lemma, 5-nerved, sulcate, the sterile palea reduced to a minute scale or lacking; fertile lemma 2.4 mm long, ovate, striate, the palea ovate, striate, with inrolled margins hyaline.

BRITISH GUIANA. Essequebo District: bottom of Potaro Gorge near Kaieteur Fall to western rim of splash-basin, Kaieteur Plateau, alt. ca. 700 ft, infrequent herb, forming mats on wet rocks in full sun, leaf blades flat, 13 Mar 1962, *R. S. Cowan & T. R. Soderstrom 2166* (holotype, US No. 2380408; isotypes, K, NY).

Thrasya achlysophila is apparently most closely related to *T. gracilis* Swallen which is known only from the type collection made on Cerro Vaca, eastern Chiriquí, Panama. The two can be separated by the following key:

1. Culms decumbent, branching at the nodes; blades linear, 2–2.5 mm wide, about 15 cm long, densely papillose-pilose on both surfaces. *T. achlysophila.*
1. Culms erect, simple; blades lanceolate, 5–8 mm wide, 3–8 cm long, at least the lower surface glabrous. *T. gracilis.*

This new *Thrasya* forms part of the dense herbaceous mat covering the boulders at the base of Kaieteur Fall where it is exposed to a continuous spray of mist from the splash-basin of the Fall. Its name is derived from the Greek words, *achlys* (mist) and *philos* (loving), in obvious allusion to its habitat.

Raddiella

Among our collections were many specimens of *Raddiella,* a tropical American genus of monoecious olyroid grasses. These small grasses prefer sunny habitats of continuous moisture and are especially fond of wet cliff faces and rocks near waterfalls where they are exposed to a fine mist. The specimens which we collected on moist cliff faces matched others previously collected on Kaieteur Plateau and tentatively referred to *R. malmeana,* a species described from the type collected much farther south in Mato Grosso, Brazil. The material from Kaieteur Plateau, however, differs in several respects from the Brazilian specimens and is described below. Specimens growing near the splash-basin of Kaieteur Fall are unlike either of those mentioned above and represent a further undescribed species. A study of all of the *Raddiella* specimens at the U. S. National Herbarium has turned up still another undescribed species, collected at Maipuri Falls in British Guiana.

Until now, the genus *Raddiella* comprised three species, two of which, *R. nana* (Doell) Swallen and *R. malmeana* (Ekman) Swallen, were transferred, respectively, from *Raddia* and *Olyra* by Swallen when he established the genus. The third, *R. truncata,* was described by him from specimens collected near Waratuk Falls in the Potaro River Gorge, British Guiana. *Raddia hoehnei* Pilger, based on Brazilian material, does not seem to differ significantly enough from extreme forms of *Raddiella nana* to warrant its recognition as a species. With the three new species described in this paper, the genus *Raddiella* is composed of six known species. Four of these are known only from habitats near waterfalls. It is plausible that these species are endemics and that additional species of the genus may be anticipated from the floras surrounding other waterfalls.

Key to the Species of *Raddiella*

1. Blades firm, triangular-oblong, tapering from a truncate base to the rounded apiculate summit, 5–8 mm wide at the base; nodes pubescent.
  2. Panicles compound, consisting of many spikelets; pedicels not thickened conspicuously below the spikelets. *R. truncata.*
  2. Panicles simple, consisting of usually 2 (rarely 3) spikelets; pedicels conspicuously thickened and cuplike below the spikelets. *R. nana.*
1. Blades thin, elliptic or elliptic-oblong, mostly 3–4 mm wide; nodes glabrous.
  3. Blades pubescent.
    4. Staminate spikelets 2–2.2 mm long, glabrous; sheaths glabrous at the summit; blades 4 mm wide or less, 1 cm long or less, hirtellous. *R. malmeana.*
    4. Staminate spikelets 4–5 mm long, pubescent at the tip; sheaths pilose at the summit; blades 5 mm or more wide, 1.5 cm long or more, hirtellous with long hairs intermixed. *R. kaieteurana.*
  3. Blades glabrous.
    5. Pistillate spikelets 1.3–1.4 mm long, staminate spikelets 2.7–3.3 mm long; sheaths much longer than the internodes; blades mostly less than 5 mm wide; peduncles in pairs at the nodes. *R. potaroensis.*
    5. Pistillate spikelets 1.7–2 mm long, staminate spikelets 3.5–4 mm long; sheaths equal to or shorter than the internodes; blades mostly more than 5 mm wide; peduncles 2–4 at the nodes. *R. maipuriensis.*

Radiella kaieteurana Soderstrom, sp. nov.

Planta annua (?) monoica; culmi decumbentes, usque ad 10(–20) cm longi, glabri; vaginae glabrae, supra marginibus pilosae; ligula 0.2–0.3 mm longa, membranacea; laminae 1.5–1.6 cm longae, 5–6 mm latae, ± rectangulares, breviter apiculatae, utrinque hirtellae; inflorescentiae terminales et axillares; spiculae masculae 4–5.5 mm longae, linearae, acutae, summam versus sparse pilosae; spiculae femineae 1.5–1.6 mm longae, ellipticae, glumis quam fructus paulo longioribus.

Monoecious annual (?); culms weak and decumbent, forming mats, the culms to 10(–20) cm long, glabrous; sheaths glabrous below, pilose on the upper margins with hairs 1–1.5 mm long, the summit more or less truncate; ligule a short inconspicuous membranous rim 0.2–0.3 mm long; blades 1.5–1.6 cm long, 5–6 mm wide, more or less rectangular with an asymmetrical base and obtuse apiculate tip, the base petiolate, 0.5 mm long, both surfaces hirtellous with long hairs intermixed; inflorescences terminal and axillary from the upper sheaths, the staminate in terminal clusters of 5 or 6 shortly exserted from the sheath, each consisting of a slender peduncle bearing 2 spikelets, the pistillate solitary or paired, shortly exserted from the upper sheaths; staminate spikelets 4–5.5 mm long, linear, acute, sparsely pilose toward the tip; pistillate spikelets 1.5–1.6 mm long, elliptic, the glumes pointed beyond the fruit, sparsely pubescent.

BRITISH GUIANA. Essequibo District (Kaieteur Plateau): along trail from Kaieteur Plateau to Tukeit, alt. ca. 1100 ft, small trailing grass on moist cliff faces in full sun, 4 Feb 1962, *R. S. Cowan & T. R. Soderstrom 1742* (holotype, US No. 2380354. Isotypes. GH, K, NY, P); gorge of Potaro River from near Johnson's View down to near base of Kaieteur Fall, alt. 600–1300 ft, infrequent annuals in shade of rocks, culms trailing and rooting at the nodes, 24 Feb 1962. Paratypes. *R. S. Cowan & T. R. Soderstrom 1918* (US); forest along trail from Kaieteur Fall to Tukeit, alt. 700–1300 ft, locally abundant annual on moist cliff walls in partial sun, leaf blades flat, 2 Mar 1962, *R. S. Cowan & T. R. Soderstrom 2027* (K, NY, US); Kaieteur Savanna, Potaro River, 1881, *G. S. Jenman 1277* (US); trail from Tukeit to Kaieteur Plateau, locally common, moist rocks, mixed forest, high level plateau, 29 Apr 1944, *Bassett Maguire & D. B. Fanshawe 23087* (NY, US).

Apparently this species of *Raddiella* is restricted to Kaieteur Plateau where it grows rather abundantly on moist cliff walls in partial sun. The weak culms trail and root at the nodes, forming large mats in places. Hitchcock, in *Grasses of British Guiana* (Contr. U. S. Nat. Herb. **22**[6]), recognized a single Jenman collection (No. *1277*), from Kaieteur Plateau, as conspecific with material from Mato Grosso, Brazil, but these are distinct species separable on a number of characters. Plants of this new species were encountered only on moist rocks in the upper parts of the Potaro River Gorge and not at the base or near the Fall, where *R. nana* and *R. potaroensis* can be found. Unlike *R. nana* and *R. truncata*, this species and the following two (along with *R. malmeana*) are delicate and have blades which are paper-thin and somewhat translucent.

Raddiella potaroensis Soderstrom, sp. nov.

Planta annua (?) monoica; culmi decumbentes, usque ad 9 cm longi, glabri; vaginae quam internodia multo longiores, glabrae, cacumine truncato; ligula ca. 0.2 mm longa, membranacea, fusca; lamine ca. 1 cm longae, 3–5 mm latae, ellipticae apice apiculatae, utrinque glabrae; inflorescentiae axillares; spiculae mas-

culae 2.7–3.3 mm longae, ellipticae, glabrae; spiculae femineae 1.3–1.4 mm longae, ovatae, glumis sparse pilosis quam fructus paulo longioribus.

Monoecious annual (?); culms decumbent, forming mats, the culms to 9 cm long, glabrous; sheaths much longer than the internodes, glabrous, truncate at the summit; ligule a short brown membranous inconspicuous rim about 0.2 mm long; blades about 1 cm long, 3–5 mm wide, elliptic with an asymmetrical base and obtuse somewhat apiculate tip, glabrous on both surfaces, the base of the blade petiolate, 0.5 mm long; inflorescences axillary, each consisting of a slender peduncle with 2 or 3 spikelets, either pistillate or pistillate and staminate, the inflorescences exserted from the sheaths in pairs; staminate spikelets 2.7–3.3 mm long, elliptic, glabrous; pistillate spikelets 1.3–1.4 mm long, ovate, the glumes pointed a little beyond the floret, sparsely pilose.

BRITISH GUIANA. Essequibo District: Kaieteur Plateau, bottom of Potaro Gorge near Kaieteur Fall to western rim of splash-basin of Fall, alt. about 700 ft, common annual forming mats on rocks in full sun in constant mist from falls, blades flat, 13 Mar 1962, *R. S. Cowan & T. R. Soderstrom 2162* (holotype, US No. 2380401; isotypes, K, NY).

This interesting little grass is exposed to a continuous mist from the Fall and contributes to the dense grass mat covering the boulders at the base of the gorge. It is more like *R. maipuriensis*, which occupies a similar waterfall habitat, than it is to *R. kaieteurana* which grows in the same gorge but higher up and with less exposure to the mist.

Raddiella maipuriensis Soderstrom, sp. nov.

Planta annua (?) monoica; culmi ascendentes vel decumbentes, glabri; vaginae quam internodia breviores, glabrae, cacumine truncato; ligula ca. 0.2 mm longa, membranacea; laminae ca. 1.5(–2) cm longae, 5–6 mm latae, utrinque glabrae; inflorescentiae axillares; spiculae masculae 3.5–4 mm longae, anguste ellipticae, glabrae; spiculae femineae 1.7–2 mm longae, ovatae, glumis quam fructus paulo longioribus.

Monoecious annual (?); culms ascending or spreading, forming mats, glabrous; sheaths shorter than the internodes, glabrous, the summit more or less truncate; ligule a short membranous rim about 0.2 mm long; blades 5–6 mm wide, about 1.5(–2) cm long, with an asymmetrical base and tip with one margin longer than the other, glabrous on both surfaces, the base of blade petiolate, 0.5 mm long; inflorescences axillary, each consisting of a slender peduncle with 2 or 3 spikelets, either all pistillate or staminate or mixed, the inflorescences exserted from the sheaths in groups of 2–4; staminate spikelets 3.5–4 mm long, narrowly elliptic, glabrous; pistillate spikelets 1.7–2 mm long, ovate, the sparsely pilose glumes pointed beyond the floret.

BRITISH GUIANA. Essequibo District: Imbaimadai Savannas, Upper Mazaruni River, abundant in spray of Maipuri Falls, Karaurieng River, alt. 1250 m, matted grass, 25 Oct 1951, *Bassett Maguire & D. B. Fanshawe 32277* (holotype, US No. 2078792; isotype, NY).

In comparison with *Raddiella potaroensis,* without doubt its closest ally, this species is larger in most respects. The two can be separated on size of pistillate and staminate spikelets, being larger in *R. maipuriensis* than in *R. potaroensis.* The wider blades of the former and presence of 2–4 peduncles at the node (rather than 2) are further characters to separate them.

CYPERACEAE tribe LAGENOCARPEAE[3]

Tribe **Lagenocarpeae.**

Tribe *Cryptangieae* Benth. & Hook. f., Gen. Pl. 3: 1042. 1883.

Spikelets unisexual, rarely dioecious, simple or compound, in the latter case sometimes bisexual. Glumes several, imbricate or more or less 2-ranked, the lower ones empty. Staminate flowers few to several to a spikelet, axillary, with (1) 2 to several stamens. Pistillate flowers solitary and terminal, trigynous rarely digynous and laterally compressed; the pistil eventually developing into a fructification with a long or short beak, the outer fructification wall sometimes more or less free and utricle-like; achenes with thick or thin pericarp enclosing an anatropous ovule; style elongate, slender, the divided part (stigmas) 3 or 2, linear, papulose. Squamellae subtending the fructification 3 (or 2 in digynous flowers, rarely wanting or more than 4) minute, ciliate or pilose on margins, rarely needle-like with spinulose margins.

Perennial sedges; flowering culms central or lateral, in the latter case arising from axils of leaves that are aggregated at the apices of elongated caudices, leaf sheaths marcescent. Inflorescence a compound panicle or paniculate fascicle, sometimes umbellate or congested in incomplete terminal heads.

Type genus. *Lagenocarpus* Nees.

Distribution. The tribe Lagenocarpeae occurs discontinuously in tropical regions of Central and South America and tropical Africa (Fig. 1, A): the Caribbean Basin; the Guayana Highland and the eastern part of the cordillera adjacent to the western boundary of the highland; the southeastern part of Brazil; tropical West Africa from Liberia to Mozambique; and Madagascar. This areal discontinuity may be related to certain eco-climatic factors. The center of the present distribution of the tribe is in the Guayana Highland where there occur six genera of which five with very similar distribution range are endemic to the Highland (Fig. 1, B and C).

Important Morphological Characters

Nees von Esenbeck[4] in 1842 described the fructification of the genus *Trilepis* of Lagenocarpeae as a 'perigynium' (utricle). Since then cyperologists paid very little attention to the structure of fructifications in the tribe Lagenocarpeae, and the fructifications have long been considered to be an achene or a nut. Recent anatomical observations made at The New York Botanical Garden on materials of most of the genera of the tribes Lagenocarpeae and Sclerieae showed that the fructifications of these tribes are not a fruit of the true achene type, but may well be considered to be a compound structure of an achene and a utricle, an assumption expressed by Nelmes[5] in his recent study on *Coleochloa* of Africa.

The presence of a utricle enclosing an achene is obvious in the pistillate flowers of the genus *Bisboeckelera* (Sclerieae) even at the gross-morphological level. In the genus *Calyptrocarya,* which is most closely related to *Bisboeckelera,* the structure of pistillate flowers are the same as the above, that is, the achene is tightly enveloped by a hyaline utricle, which is completely free from the achene

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[3] By Tetsuo Koyama and Bassett Maguire.

[4] Nees von Esenbeck, C. G. Cyperaceae. *In* Martius, Fl. Bras. 2(1): t. 19. 1842.

[5] Nelmes, E. Notes on Cyperaceae: XXXI. The African genus *Coleochloa.* Kew Bull. 8: 373–381. 1953.

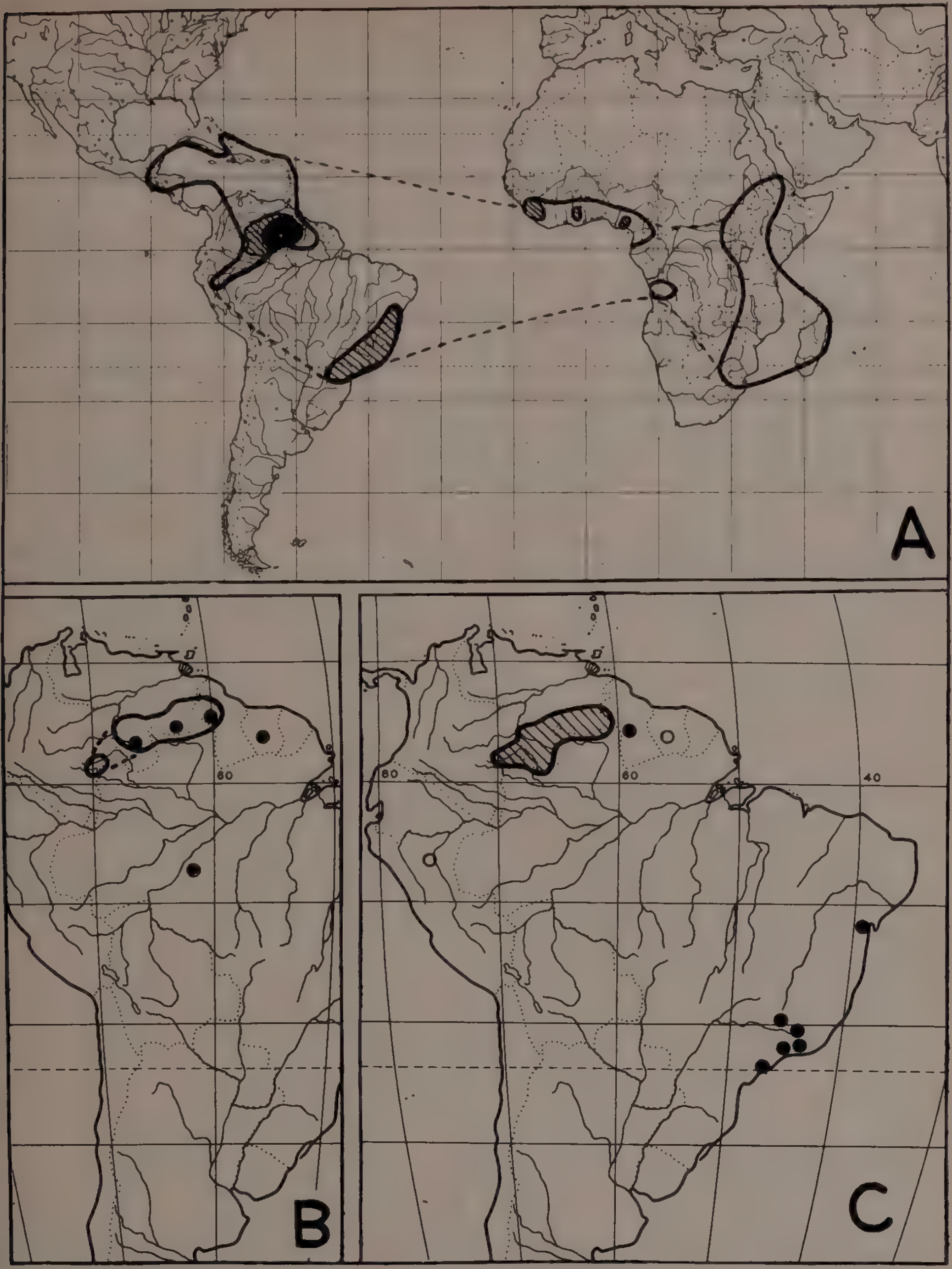

FIG. 1. Maps showing distribution of Cyperaceae tribe Lagenocarpeae. A. Distribution ranges of the tribe showing concentration. Continuous lines: 1 genus; diagonal hatches: 2 genera; black patch: more than 3 genera. The ranges in Africa partially based on Raynal (1963). The range covering East Africa and Madagascar: *Cocleochloa;* ranges in West Africa: *Afrotrilepis* including *Microdracoides* in hatched portions. *Lagenocarpus* occupies entire ranges in Central and South America. For ranges of the other South American genera see maps B and C for details. B. Continuous lines: *Cephalocarpus*. The range of *Didymiandrum* overlaps that of *Cephalocarpus*. Black circles: *Exochogyne*. C. Black circles: *Trilepis*. Diagonal hatches and open circles: *Everardia*.

under a low-power microscope. (Details of the fruit anatomy of the Sclerieae will be included in a future paper.)

In the genera *Trilepis, Afrotrilepis, Microdracoides* and *Coleochloa* (Lagenocarpeae) the outermost fructification wall, which has hitherto generally been termed "pericarp," is structurally very similar to the utricle in *Calyptrocarya* and is here called a utricle (Fig. 2, A: U). The utricle is, like that of *Calyptrocarya,* quite sac-like and is free from the enclosed achene. The achene consists of trigonal body composed of the seed enveloped by a thin pericarp. The surmounting slender style extends through the beak of the utricle. The seed itself has an indurated testa (Fig. 2, A: st, p).

As the lower parts of the utricles and the pericarps are of thin, unicellular epidermal layers, the seed can be seen through the wrappers. With such a hyaline pericarp and relatively thick seed coat, the achenes of the *Trilepis*-group differ considerably from those of the Caricoideae, Scirpoideae or Rhynchosporoideae, which have a thick pericarp and a thin seed coat.

In the fructifications of the rest of the lagenocarpeous genera the utricle cannot be readily recognized. The fructifications of *Cephalocarpus, Everardia, Lagenocarpus* and *Didymiandrum* are structurally divided into two parts, the lower part (body) and the upper part (beak) (Fig. 2, B–D). In the body, the fructification wall consists of two different tissues, the epidermal outer layer (Fig. 2: e) and the sclerenchymatous inner layer (Fig. 2: s). The vascular bundles (Fig. 2: b), which are three to a trigynous fructifications and two to a digynous ones, are seen between the two layers or in the outer epidermal layer, and they are considered to be utricular bundles. A parenchymatous tissue (Fig. 2: p) develops around each bundle. An anatropous ovule (Fig. 2: Ov) is located at the bottom of the large locule.

From this organization it is difficult to determine whether or not the *Lagenocarpus*-type fructifications are a compound structure consisting of a utricle and a true achene. There are evidences which may shed a light on this problem. Marek[6] has examined the pericarps in various European genera of the Cyperaceae including *Carex, Cyperus, Rhynchospora* and *Scirpus*. According to his descriptions, in the cyperaceous achenes the pericarp usually has no distinct mesocarp, and it is difficult to interpret the parenchymatous tissue of the *Lagenocarpus*-type fructifications to be mesocarp. The sclerenchymatous layer (Fig. 2: s) of the *Lagenocarpus*-type fructifications is, by itself, structurally similar to the pericarp in the cyperaceous achenes described by Marek. Furthermore, at the base of the fructification beak the sclerenchymatous layer is abruptly converged, and in the beak it continues as a style surmounted (Fig. 2: St). The style, apparently continuing into the stigmas, is structurally the same as the normal style in the other cyperaceous genera.

In the *Lagenocarpus*-type fructifications the utricle appears to be adnate to the pericarp for its entire length. Adnation is so complete that no distinction can be made between the utricle and the pericarp. In the fructifications of *Cephalocarpus* (Fig. 2, B) the truncated or shallowly depressed apex of the sclerenchymatous layer and the base of the central vascular bundle are free from the outer wall of the utricle producing a cavity around the style (Fig. 2, B: itc). This suggests that the fructification wall is of compound origin.

The fructifications of *Exochogyne* without doubt fall under the morphologi-

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[6] Marek, S. A study of the anatomy of fruits of European genera in the subfamilies Scirpoideae Pax, Rhynchosporoideae Aschers. et Graebner and some genera of Caricoideae Pax. Monogr. Bot. **6**: 151–177. t. 1–6. 1958.

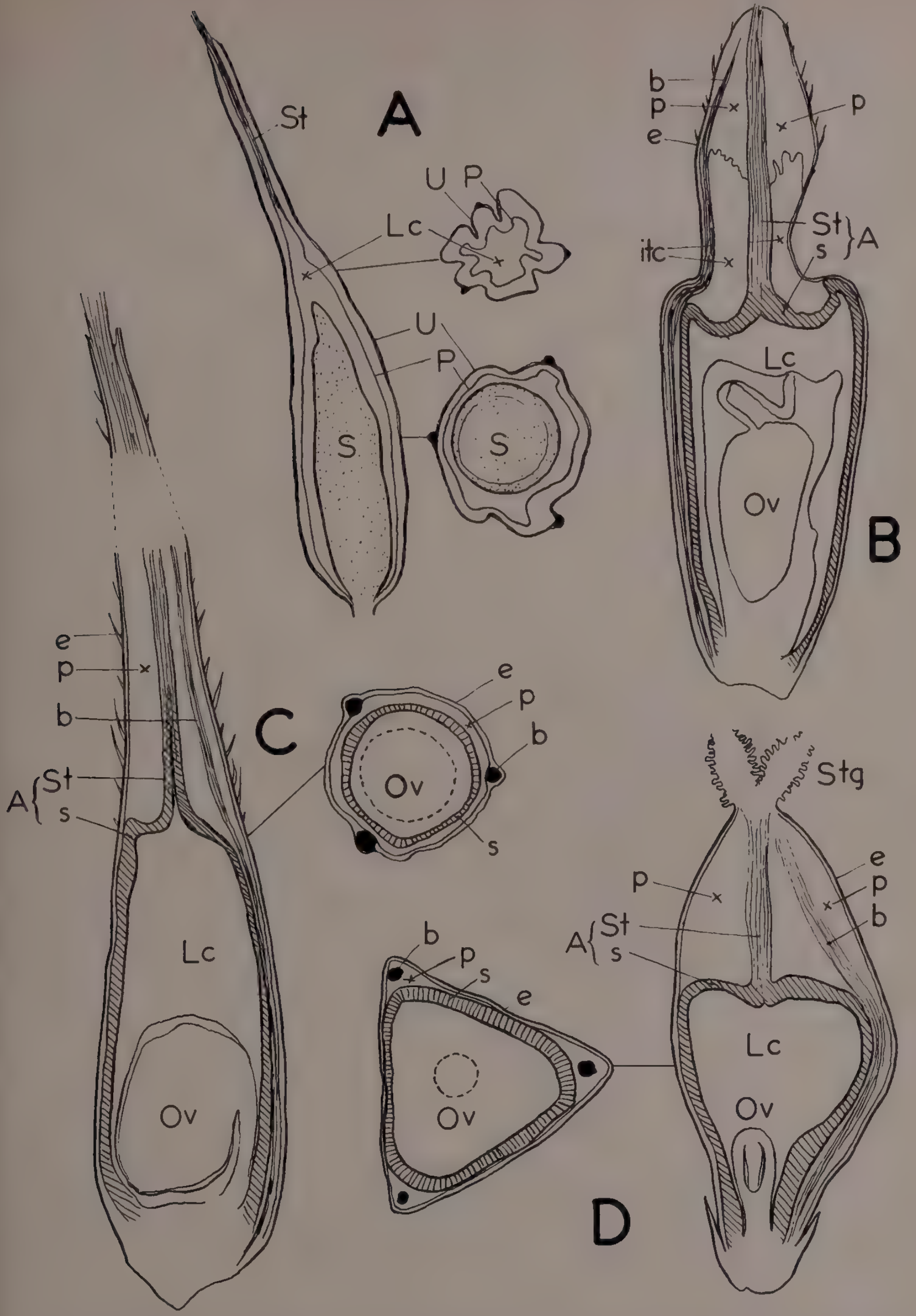
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FIG. 2. Structure of fructification in Lagenocarpeae. A. *Trilepis*, a longitudinal section and transverse sections at two different levels. B. *Cephalocarpus*, a longitudinal section. C. *Everardia*, a longitudinal section and a transverse section at the apex of the fructification body. D. *Didymiandrum*, a longitudinal section and a transverse section at the middle part. A: Achene; b: Utricular vascular bundle; e: Epidermal tissue; itc: Inter-tissue cavity; Lc: Locule; P: Pericarp; p: Parenchymatous tissue; Ov: Ovule; S: Seed; s: Sclerenchymatous tissue; St: Style, or vascular supply thereof; U: Utricle.

cal category of the *Lagenocarpus*-type. They are, however, digynous with a two-stigmatic pistil and a fructification wall with two vascular bundles, whereas typical *Lagenocarpus*-type fructifications are trigynous with a three-stigmatic pistil and three bundles. It is interesting to observe that the digynous fructifications of *Exochogyne* are bilaterally compressed like those of the subgenus *Pycreus* of *Cyperus*, a condition that seldom obtains in specialized groups of the Cyperaceae such as *Cyperus* subgen. *Kyllingia* and *Rhynchospora* sect. *Capitatae*. As was maintained in an earlier paper,[7] the bilateral digyny of fruits in the Cyperaceae is considered to be evolutionally advanced.

At the base of the fructifications are small scales, which are hyaline with ciliate or pilose margins, generally termed hypogynous squamellae. They are as a rule three to a trimerous flower, and two to a dimerous flower, or rarely more than three regardless of the number of carpels. They are eliminated by reduction in *Exochogyne* and some species of *Lagenocarpus*. Because of their number, their position and their form differing from that of the spicular glumes, they are usually interpreted as a rudimentary perianth. But, in our anatomical observation, an abscission layer was seen above the squamellae. In the cyperaceous flowers an abscission layer is normally seen below the perianth bristles, and the perianth elements are persistent to the achene. This fact suggests that the squamellae in Lagenocarpeae are metamorphosed glumes rather than floral segments.

It is also useful to consider the origin of the utricles in the tribes Lagenocarpeae and Sclerieae. The position of the utricle relative to the abscission layer and the squamellae strongly suggest the perianth origin of the utricle. The utricles in the tribe Cariceae resemble those of the *Trilepis*-group and *Bisboeckelera*-group except that those of the former always have two costae rather than three nerves as in the latter two groups. In previous studies,[8, 9] the utricle in the Cariceae has been interpreted to be a metamorphosed bracteole at the base of a rhachilla on which a pistillate flower is borne. The similar structures in each of the two groups show merely a superficial analogy, but in no sense homology. There is no close phyletic relationship between Cariceae and Lagenocarpeae or Sclerieae.

In the Lagenocarpeae some genera like *Everardia, Microdracoides* or *Trilepis* develop a quite characteristic elongated caudex. This structure is useful as a key character in the distinction of genera. Such elongated caudices occur in two different tribes of Cyperaceae, and in monocotyledonous families as the Velloziaceae, Eriocaulaceae, Xyridaceae, Bromeliaceae and others, which among themselves may have no close taxonomic interrelationships.

Generic Interrelationships within the Lagenocarpeae

In the tribe Lagenocarpeae the degree of adhesion of the fructification wall to the achene sheds a light on an apparent evolutionary trend within the tribe. It is generally held that in the Cyperaceae the evolutionary process proceeds from parts being free to connation or adnation of parts, and from compound to simple parts.[10-12] The *Trilepis*-type fructification with a free wall may, therefore, give way to the *Lagenocarpus*-type fructification with a wall completely adherent to the achene. *Cephalocarpus* occupies an intermediate position by its partially free wall. Furthermore, transition by probable reduction is seen in the modification of the beak from long to short or by its complete absence as in *Lagenocarpus celiae*. The *Trilepis*-type fructification invariably has a long beak, and would, therefore, be interpreted as primitive. The *Lagenocarpus*-type fructification tends to have a short or vestigial beak, and would, therefore, be interpreted as advanced.

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[7] Koyama, T. Classification of the family Cyperaceae (3). Quart. Jour. Taiwan Mus. **14**: 159–194. 1961.

[8] Blaser, H. W. Studies in the morphology of the Cyperaceae. II. The prophyll. Am. Jour. Bot. **31**: 53–64. 1944.

[9] Koyama, T. Classification of the family Cyperaceae (1). Jour. Fac. Sci. Univ. Tokyo III, **8**(3): 37–148. 1961.

Other tendencies with evolutionary significance parallel the trend suggested above, as shown in Table 1.

TABLE 1

	Trilepis-group (primitive)	*Lagenocarpus*-group (advanced)
Inflorescences	compound-paniculate	fasciculate, corymbose or umbellate, rarely congested in heads
Spikelets	bisexual or compound or both, when compound partial spikelets comprise a spikelet proper	unisexual and simple
Hypogynous squamellae	large with pilose margins	small to vestigial, rarely none, the margins ciliolate or glabrescent

The genus *Trilepis* of South America, possessing the presumptive most primitive features within the tribe, is more closely related to the African genera *Coleochloa, Afrotrilepis* and *Microdracoides* than to its five American congeners. This distribution would suggest an early trans-oceanic migration or the existence of an early continuous landmass, and a single line of development.

The five presumptive more advanced genera have their center of distribution in the Guayana Highland, with only *Lagenocarpus* occupying the entire American range. It becomes clear that the contemporary center of distribution of Lagenocarpeae as a whole is tropical America. Indeed the archetypes of the tribe may well have arisen within the present American range.

From those considerations there may well be postulated a monophyletic origin for the Lagenocarpeae with a probable genesis in what is now America; that there has been a subsequent evolutionary assurgence within the tribe in Guayana; and that rather little subsequent evolutionary progress has been made in peripheral Africa.

Key to Genera of Lagenocarpeae

1. Achenes free from fructification walls, the pericarp membranous or hyaline; spikelets compound at least in part.
  2. Bisexual spikelets intermixed with staminate spikelets.
    3. Leaf sheaths free on margins; contra-ligule wanting; caudex short (East African). *Coleochloa.*
    3. Leaf sheaths cylindric with connate margins; contra-ligule more or less produced; caudex elongate (West African). *Afrotrilepis.*
  2. Spikelets unisexual.

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[10] Mattfeld, J. Zur Morphologie und Systematik der Cyperaceae. Proc. Intern. Bot. Congr. Amsterdam, 330–332. 1915.

[11] Holttum, R. E. The spikelets in Cyperaceae. Bot. Rev. **14**: 525–541. 1948.

[12] Savile, D. B. O. and Calder, J. A. Phylogeny of *Carex* in the light of paraticism by the smut fungi. Can. Jour. Bot. **31**: 162–174. 1953.

4. Plants monoecious; stigmas 3 (Brazilian except for *T. kanukuensis* of British Guiana). *Trilepis.*
4. Plants monoecious; stigmas 2 (West African). *Microdracoides.*
1. Achenes adnate to fructification walls at least in major part, the pericarp indurated; spikelets simple.
  5. Fructifications trigonous with 3 stigmas; glumes imbricate.
    6. Caudex elongate; flowering culms lateral arising from axils of leaves; hypogynous squamellae long-pilose.
      7. Apices of fructifications abruptly contracted to truncate neck to which a clavate beak is attached, the beak hollow below the middle and enlarged toward apex. *Cephalocarpus.*
      7. Fructification gradually attenuate above to a subulate or conical beak, the beak solid and not enlarged at apex. *Everardia.*
    6. Caudex short; flowering culms central; hypogynous squamellae ciliolate.
      8. Plants monoecious; leaves linear, radical or subradical. *Lagenocarpus.*
      8. Plants dioecious; leaves lance-oblong, cauline, making pseudo-whorls at nodes of culms. *Didymiandrum.*
  5. Fructifications bilaterally compressed with 2 stigmas; glumes 2-ranked. *Exochogyne.*

Coleochloa Gilly, Brittonia **5**: 12. 1943. Based on *Eriospora* Hochst. non Berk. & Broome.

Eriospora Hochst. ex A. Rich., Tent. Fl. Abyss. **2**: 508. Not *Eriospora* Berk. & Broome, 1850. Type: *Eriospora abyssinica* Hochst.
Catagyna Beauv. sensu Hutchinson, Fl. West Trop. Afr. **2**: 490. 1936. In part.

Type species. *Coleochloa abyssinica* (Hochst.) Gilly.

Nelmes (1953) recognizes seven species in East Africa and Madagascar.

Afrotrilepis (Gilly) Raynal, Adansonia **3**: 258. 1963. Based on *Trilepis* subgen. *Afrotrilepis* Gilly.

Trilepis Nees subgen. *Afrotrilepis* Gilly, Brittonia **5**(1): 15. 1943.

Type species. *Afrotrilepis pilosa* (Böcklr.) Raynal.

Raynal (1963) recognizes two species, *A. pilosa* and *A. jaegeri,* from tropical West Africa. This genus closely resembles *Trilepis,* from which it differs only by bisexual spikelets. In *Cyperaceae* the sexes of spikelets are very variable and are not always valid for taxonomic segregation though they have a certain evolutional significance. In order to test the validity of *Afrotrilepis* more detailed studies in anatomy and perhaps cytology are necessary.

Trilepis Nees, Linnaea **9**: 305. 1834; emend. Nees, Fl. Bras. **2**(1): 197. 1842.

Fintelmannia Kunth, Enum. Pl. **2**: 362. 1837. Type: *Fintelmannia restioides* Kunth.

Perennials with ascending, slender caudices covered with residues of leaf sheaths more or less disintegrating into fibers. Leaves slender, obscurely jointed at base of blades; contra-ligule deltoid to lanceolate; sheaths eventually split into reticulate or parallel fibers. Flowering culms arising from axil of leaves. Inflorescence paniculate, compound with elongated branches. Spikelets proper compound, as a rule unisexual, consisting of 3 to 50 partial spikelets, the pistillate ones borne towards apex of inflorescence, staminate ones borne towards the panicle base. Staminate spikelets with more or less distichous several glumes, few- to several-flowered; stamens 2 or 1 to a flower. Pistillate partial spikelets 1-flowered; glumes 3, 1 outer abaxial, 2 inner lateral. Fructifications subtended by 3 pilose hypogynous squamellae, utricles lanceolate, hyaline, free from oblong achene; stigmas 3.

Type species. *Trilepis lhotzkiana* Nees.

Distribution. See Fig. 1, C. The species of *Trilepis* have been recorded from several localized stations in southeastern Brazil, from São Paulo and Rio de Janeiro through Minas Gerais northeastwards to Bahia, and a disjunct station in British Guiana. As a rule they grow on granitic rocks, whereas the species of *Everardia* occur in sandstone areas. As the species of *Trilepis* are characteristically quite uniform not many characters are of significance in distinguishing species. In most cases the vegetative parts including the length and width of leaves and the height of culms vary to a considerable extent in accordance with edaphic factors, especially the humidity of localities. The number of partial spikelets comprising a spikelet proper, and the color of glumes and sheaths are not as variable as dimensions of vegetative parts or the number of spikelets proper in a panicle, but still are not of specific significance. The size and thickness of contra-ligules and the length of mature fruits seem to be the only reliable characters useful for specific separation. Of six species described by previous authors we here recognize only three species, based on the dimensions and thickness of contra-ligules and the length of mature fruits in association with the other characters mentioned above. The recognized species are *T. lhotzkiana*, *T. kanukuensis* and *T. microstachya* as keyed below. Each of the three has its own range in dimensions of contra-ligules and mature fructifications as shown in the scatter diagram of Fig. 3.

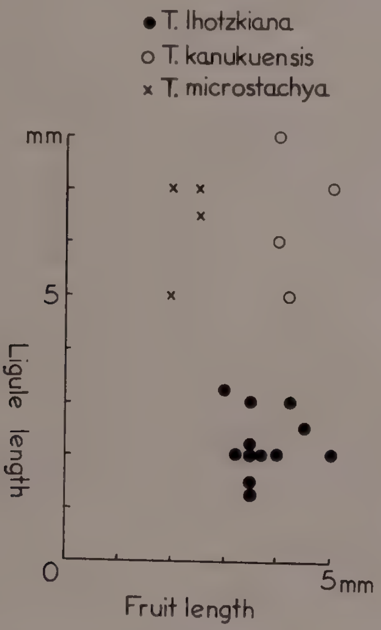

Fig. 3. Scatter diagram showing the ranges of ligule and fruit (= fructification) length in the three species of *Trilepis*.

Key to Species of the Genus *Trilepis*

1. Contra-ligules thinly coriaceous, deltoid, colored with purplish-brown, 1.5–3 mm long; sheaths disintegrating into reticulate fibers; flowering spikelets-proper 6–9 mm long, with 15–50 partial spikelets. 1. *T. lhotzkiana.*

1. Contra-ligules membranous to hyaline, lance-oblong, pale or nearly so; flowering spikelets-proper 2–6 mm long, with 3–6 partial spikelets.
   2. Utricles 3.5–4.5 mm long, exceeding the uppermost glume; glumes purplish-brown. 2. *T. kanukuensis.*
   2. Utricles 2–2.5 mm long, as long as the uppermost glume; glumes blackish purple. 3. *T. microstachya.*

1. **Trilepis lhotzkiana** Nees ex Arnott, Edinb. N. Phil. Jour. **17**: 267. 1834; Nees, Linnaea **9**: 305. 1834.

Fintelmannia restioides Kunth, Enum. Pl. 2: 263. 1837.
Fintelmannia eximia C. B. Clarke, Kew Bull. Add. Ser. 8: 66. 1908. Syn. nov.
Fintelmannia robusta C. B. Clarke, Kew Bull. Add. Ser. 8: 67. 1908. Syn. nov.
Fintelmannia lhotzkiana (Nees) H. Pfeiffer in Fedde, Repert. Sp. Nov. 18: 384. 1922. Invalid combination in synonymy.
Trilepis eximia (C. B. Clarke) H. Pfeiffer in Fedde, Repert. Sp. Nov. 18: 385. 1922.
Trilepis lhotzkiana Nees forma *robusta* (C. B. Clarke) H. Pfeiffer in Fedde, Repert. Sp. Nov. 18: 384. 1922.
Trilepis alcatrazensis Gilly, Brittonia 5: 17. 1943. Syn. nov.

Type. Near Sebastianopoli, Corcovado, on wet rocks, Rio de Janeiro, Brazil. *Lhotzky* (reportedly in W).

Distribution. Known from Rio de Janeiro, São Paulo, Minas Gerais and Bahía. The record from Bahía is based on Lindmann (Bih. L. Svensk. Vet.-akad. Nya Handl. Stockh. 26, Afd. **3**(9): 35. 1900), who cited a Regnell's collection from the vicinity of Bahía, which has not been seen by us. BRAZIL. Without definite locality, *Burchell 1107* (GH). São Paulo: Ilha dos Alcatrazes, *Luderwaldt & Pinto 9333* (NY, holotype of *T. alcatrazensis*). Rio de Janeiro: without definite locality, *Sellow in 1814–15* (B, type of *Fintelmannia restioides;* F, photo), *Glaziou 13313* (C, type of *T. eximia,* B, P, US, isotypes; F, photo), *Glaziou 12256* (B, K, P, syntypes or isosyntypes of *Fintelmannia eximia*), *Glaziou 6764* (C, lectotype of *Fintelmannia robusta;* P, isotype; F, photo), *Gardner 149* (NY, US); near Rio de Janeiro, rocks, *Riedel 933* (US); near Ipanema, on granite, *von Luetzelburg 15478A* (F); Lagoa de Freitas, *Glaziou 12298* (F, NY, P, US); Nova-Friburgo, *Leite 4279* (F); Corcovado, *Ule 887* (B, syntype of *Fintelmannia robusta*); Gávea, wet granite, alt. 800 m, *von Luetzelburg 43;* Organ Mts., alt. 1700 m, *von Luetzelburg 6448.* Distr. Federal: Pedra da Gávea, alt. 850 m, sloping ledge just below summit on east side, *L. B. Smith 6443* (US); Minas Gerais: Turvo, *Hoene & Gehrt 17568;* Serra de Gramma, alt. 1700 m, *Chase 9569* (US).

Pfeiffer (1922) and Gilly (1943) pointed out that broad-leaved *T. eximia* very closely resembles narrow-leaved *T. lhotzkiana,* and the latter author suggested that *T. eximia* might well be considered to be conspecific with the latter when the variability could be checked on sufficient amount of specimens. Our observations made on specimens available at major U. S. herbaria support Gilly's assumption. All specimens of the *T. lhotzkiana–T. eximia* complex well agree with each other in the length of fructifications and the dimension of contra-ligules, which are the most stable characters in the genus *Trilepis.* Leaf blades vary from 1.5 to 6 mm in width quite continuously. Similarly, as to the inflorescences, various degrees of branching have been seen. They range without discontinuity from almost simple spike on low culms to obvious panicle on tall culms. Field notes on labels state that tall *T. eximia* grows on wet rocks whereas *T. lhotzkiana* of low stature occurs in more dry habitats. From these morphological-habital evidences we consider that *T. eximia* is not a biological entity but is an ecological expression. A photograph of the type of *Fintelmannia robusta* at the Chicago Natural History Museum shows that it is intermediate. *T. alcatrazensis* was segregated from *T. lhotzkiana* by its elongated caudex and longer, hyaline contra-ligules. However, specimens examined showed intergradation as to the length of internodes or caudices. In Gilly's type of *T. alcatrazensis* the contra-ligules are not hyaline, and we cannot understand why Gilly segregated it from *T. lhotzkiana* by the "hyaline" contra-ligules. The ovate-deltoid, more or less coriaceous ligules are a good match with those of typical *T. lhotzkiana*. The three names discussed here are, therefore, relegated to the synonymy under *T. lhotzkiana*.

2. **Trilepis kanukuensis** Gilly, Brittonia **5**: 18. 1943.

Type. Northwestern portion of Kanuku Mts., Mt. Iramaikpang, open rocky summit, densely matted herb on cracks of rock, abundant, alt. 975 m, British Guiana. *Albert C. Smith 3643* (NY, holotype; F, A, isotypes).

Distribution. Known only by the type collection.

A specimen from Minas Gerais, *G. Mendes de Magalhaes 28,101* (F), agrees with *T. kanukuensis* in vegetative characters, especially in the particular feature of contra-ligules, but the spikelets are too immature for more accurate determination. The locality suggests that this belongs to an undescribed taxon.

3. **Trilepis microstachya** (C. B. Clarke) H. Pfeiffer in Fedde, Repert. Sp. Nov. **18**: 385. 1922.

Fintelmannia microstachya C. B. Clarke, Kew Bull. Add. Ser. 8, 66. 1908.

Type. Rio de Janeiro, Haut de Orgaos, Brazil. *Glaziou 17347* (K, lectotype; F, P, isotypes).

Distribution. Known from Minas Gerais and Rio de Janeiro. BRAZIL. Rio de Janeiro: without definite locality. *Glaziou s.n.* Minas Gerais: *Schwacke 8732* (B, syntype).

Microdracoides Hua, Bull. Mus. Hist. Nat. Paris **12**: 421. 1906.

Schoenodendron Engler, Bot. Jahrb. **44**(Beibl. Nr. 101): 34. 1910. Type: *Schoenodendron bucheri* Engl.

Monotypic genus: *Microdracoides squamosus* Hua.

1. **Microdracoides squamosus** Hua, Bull. Mus. Hist. Nat. Paris **12**: 422. 1906.

Schoenodendron bucheri Engler, Bot. Jahrb. **44**(Beibl. Nr. 101): 34. 1910.

Type. River Lanfofome, French Guiana. *Pobeguin 1059* (P, lectotype).

Distribution. Tropical West Africa. Guinea: Fouta Djalon, Knikon, *Adam 11828* (♀) (Herb. M. Raymond).

Cephalocarpus Nees, Fl. Brasil. **2**(1): 168. *t. 18*. 1842.

Lagenocarpus subgen. *Cephalocarpus* (Nees) H. Pfeiffer in Fedde, Repert. Sp. Nov. **18**: 91. 1922.

Cephalocarpus subgen. *Eucephalocarpus* Gilly, Bull. Torrey Club **69**: 293. 1942. Type species: *Cephalocarpus dracaenula* Nees.

Cephalocarpus subgen. *Neocephalocarpus* Gilly, Bull. Torrey Club **69**: 293. 1942. Type species: *Cephalocarpus rigidus* Gilly.

Terrestrial or epiphytic perennials. Upper-ground caudices elongate, sometimes branched, woody, clothed with residues of leaf sheaths usually disintegrating into parallel fibers. Leaves congested at apices of caudices, linear, usually hispidulous particularly on margins; sheaths connate on margins without conspicuous contra-ligules. Flowering culms single or of fascicle of several at the axil of leaves, surrounded at base with a bicarinate bladeless sheath. Spikelets congested in a head-like cluster at culm-apices, unisexual, staminate and pistillate intermixed; glumes imbricate. Staminate spikelets with a few lower empty glumes, few flowered toward apex; stamens 1 to 3 (mostly 2) to a flower. Pistillate spikelets 1-flowered; pistils trigonous with pilosulous hypogynous squamellae; fructifications ovate-elliptic to ovate-oblong, obtusely trigonous; utricles adnate to achene below the shoulder, free at the apices of achene yielding a cavity around the stylebase; the beak clavate, empty at base, solid and slightly enlarged at more or less pubescent apex.

Type species. *Cephalocarpus dracaenula* Nees.

Distribution. See Fig. 1, B.

Key to Species of *Cephalocarpus*

1. Flowering culms 3 to 8 in the axil of a single leaf, enclosed by a bladeless sheath; utricular beaks short conical with short stipe-like base.
    2. Fructifications obovate, 1–1.25 mm across, rounded at apex, the beak pubescent at tip. 1. *C. dracaenula.*
    2. Fructifications ovate-oblong, 0.8 mm across, truncate at apex, the beak glabrous or glabrescent at tip. 2. *C. confertus.*
1. Flowering culms solitary in the axil of a single leaf, arising from an ochreate sheath; utricular beaks elongate, obovate-oblong to clavate with more or less elongate stipe-like base. 3. *C. rigidus.*

1. **Cephalocarpus dracaenula** Nees, Fl. Brasil. **2**(1): 162. *t. 18.* 1842. Fig. 7, G–H.

Type. Río Caqueta, Amazonas, Colombia. *Martius* (M, GH; US, photo of holotype).

Distribution. Known only from Caqueta. COLOMBIA. Caquetá: cataracts of River Japuru, *Martius* in 1841 (GH; cited by Gilly, Bull. Torrey Club **69**: 294. 1942, as isotype); La Pedrera and vicinity, Cerro de la Pedrera, *Schultes & Cabrera 16305* (F, NY, US), *17667* (US), *Schultes 5858* (US). Vaupés: Río Piraparana, cuenca del Río Apaporis, alt. 250–600 m, *H. Garcia-Barriga 14332* (US); Río Guainia, Río Naquieni, vicinity of Cerro Monachi, *R. E. Schutes & Lopez 10066* (US).

2. **Cephalocarpus confertus** Gilly, Bull. Torrey Club **69**: 293. *f. 1 a–c.* 1942. Fig. 7, K–L.

Type. Summit, dry ridge tops, Savanna Hills, 4400 ft, Mt. Duida, Amazonas, Venezuela. *G. H. H. Tate 800* (NY, holotype).

Distribution. Endemic in the Guayana sandstone area. VENEZUELA. Amazonas: summit of Cerro Duida, Savanna Hills, alt. 1025–1200 m., *Steyermark 58238* (NY, F). Bolívar: La Gran Sabana, Ilu-tepuí, Mesa Ridge at alt. 1950 m, frequent in rocky exposed places, *Maguire 33394;* Ptari-tepuí, dry rocks and shaded ground below large boulders, alt. 1600 m, *Steyermark 59625;* Mt. Roraima, on the great sandstone boulders, Philip Camp, alt. 5200–6000 ft, *Tate 285.*

3. **Cephalocarpus rigidus** Gilly ex Gleason & Killip, Brittonia **3**: 152. *f. 2 a–b.* 1942. Fig. 7, I, J, M, N.

Cephalocarpus rigidus var. *typicus* Gilly, Bull. Torrey Club **69**: 296. *f. 1 g–i.* 1942.
Cephalocarpus rigidus var. *mucronatus* Gilly, Bull. Torrey Club **69**: 296. *f. 1 j–l.* 1942. Syn. nov.
Cephalocarpus longibracteatus Gilly ex Gleason & Killip, Brittonia **3**: 153. *f. 2 d–j.* 1939. Syn. nov.
Cephalocarpus lineariifolius Gilly, Bull. Torrey Club **69**: 295. *f. 1 f.* 1942. Syn. nov.
Cephalocarpus maguirei Gilly, Bull. Torrey Club **76**: 292. 1949. Syn. nov.
Cephalocarpus steyermarkii Gilly, Fieldiana Bot. **28**(1): 54. 1951. Syn. nov.

Type. Without particulars, Mt. Duida, Amazonas, Venezuela. *G. H. H. Tate 1346* (NY, holotype).

Distribution. *Cephalocarpus rigidus* in this revised sense has a range extending throughout all of Venezuelan Guayana on Roraima sandstone. Similar distribution patterns are presented by *Didymiandrum stellatum*, *Everardia montana* and *Exochogyne amazonica*, which seem to have expanded well over the potential area determined by edaphic factors.

VENEZUELA. Amazonas: Cerro Sipapo, *Maguire & Politi 27592 & 27826.* Cerro Yutaje, *Maguire & Maguire 35389;* Serrania Parú, *Cowan & Wurdack 31337;* Cerro Huachamacari, *Maguire, Cowan & Wurdack 30070 & 30159;* Cerro Duida, *Maguire & Maguire, Jr. 29212, Tate 720, 721* (NY, holotype of *C. rigidus* var. *mucronatus*, from summit, 6800 ft, Ridge 16), *Tate 1035* (NY, holotype of *C. lineariifolius*, from flat near stream at Central Camp at summit, 4800 ft), *Tate 1345* (NY, holotype of *C. longibracteatus*). Bolívar: Cerro Guaiquinima. *Maguire 32764, 32831, 32911, 33054;* Auyán-tepuí, *Vareschi & Foldats 4877;* Chimantá Massif, *Steyermark & Wurdack 805, 1120;* Ptari-tepuí, *Maguire & Wurdack 33916, Steyermark 59640* (F, holotype of *C. steyermarkii;* NY, isotype, from scrubby forest on rocky open portion of plateau on southeast slopes, alt. 1600 m); Ilu-tepuí, *Maguire 33393, 33632;* Uei-tepuí (Cerro do Sol), *Steyermark & Nilsson 342, 609.* BRITISH GUIANA. Pakaraima Mts., *Maguire & Fanshawe 32051;* Kaieteur Plateau, *Maguire & Fanshawe 23453* (NY, holotype of *C. maguirei,* from Kaieteur savannas).

Variations in *Cephalocarpus rigidus,* the only widespread species of the genus, have been observed from the ample collections kept at The New York Botanical Garden. Inflorescences vary most markedly from a fascicle of several clusters of spikelets as much as 3 cm long to almost a single head with several spikelets about 1 cm in diameter. The bracts and floral glumes vary in length in accordance with the size of inflorescence. The range of the length of fructifications is from 1.5 to 2.2 mm. Leaf blades vary in the density of pubescence. No discontinuity was found in any of these characters. All species and varieties described by Gilly under his subgenus *Neocephalocarpus* fall within the variation range mentioned above, and hardly represent discrete taxa even at infraspecific levels. All of these names are, therefore, united under the earliest valid name, *Cephalocarpus rigidus.*

Excluded Species

Cephalocarpus clarkii H. Pfeiffer = **Lagenocarpus clarkii** H. Pfeiffer
Cephalocarpus comatus H. Pfeiffer = **Lagenocarpus comatus** H. Pfeiffer
Cephalocarpus humilis H. Pfeiffer = **Lagenocarpus humilis** O. Kuntze
Cephalocarpus polyphyllus H. Pfeiffer = **Lagenocarpus polyphyllus** O. Kuntze
Cephalocarpus schenkianus H. Pfeiffer = **Lagenocarpus schenkianus** H. Pfeiffer

Everardia Ridley ex im Thurn, Timehri (Jour. Roy. Agr. & Comm. Soc. Brit. Guiana) **5**: 210. 1886; Ridley in Oliver, Trans. Linn. Soc. Ser. **2**(2): 287. 1887.

Terrestrial or more or less epiphytic perennials. Caudexes erect or ascending, woody, thickly clothed with residues of leaf sheaths often disintegrating into parallel or reticulate fibers. Leaves aggregated, blades linear, stiff or stiffish, often pubescent especially towards base; sheaths connate-margined with produced contra-ligules. Flowering culms lateral, arising from axils of leaves, always solitary, clothed at base with a bladeless sheath. Inflorescence an interrupted or contiguous compound panicle, occupying the greater part of culms. Spikelets unisexual (very rarely dioecious), the staminate ones generally born on middle and lower portions of branchlets whereas the pistillate towards apices; glumes imbricate. Staminate spikelets several-flowered, the lower 3 to 8 glumes empty; stamens as a rule 6 (rarely 3 or up to 8) to a flower. Pistillate spikelets 1-flowered; pistils trigynous with long pilose hypogynous squamellae; fructifications obovoid to oblanceolate, obtusely trigonous; utricles adnate to achenes for total length without cavity, the beak subulate, sometimes reduced to a short conical mucro.

Type species. *Everardia montana* Ridley ex im Thurn.

Distribution. See Fig. 1, C.

Key to Species of *Everardia*

1. Culms rigid, taller than leaves when normally grown, scarcely bearing spikelets below the middle; fructifications with elongate beak; stamens 4–6. Sect. *Everardia*.
    2. Beak of fructifications linear to linear-subulate, conspicuously longer than the narrowly oblong body.
        3. Leaves irregularly 3-ranked; body of fructifications truly oblong, longer than the ciliae of hypogynous squamellae.
            4. Hypogynous squamellae ciliate with long silky hairs which are 1–3 mm long; the longest glume less than 6 mm long.
                5. Beak of fructifications glabrous; leaf-blades glabrous except on lower margins.
                    6. Hairs of hypogynous squamellae crisped; pistillate glumes not recurved; leaf-blades glabrous on margins. 1. *E. diffusa.*
                    6. Hairs of hypogynous squamellae straight; pistillate glumes recurved in fruit; leaf-blades ciliate particularly on lower margins. 2. *E. recurvigluma.*
                5. Beak of fructifications pubescent; leaf-blades wholly pubescent with soft adpressed hairs.
                    7. Leaves 5–7 mm wide; sheaths chestnut brown; inflorescence elliptic, contiguous, the branches well divided. 3. *E. vareschii.*
                    7. Leaves 2–3 mm wide; sheaths blackish brown; inflorescence slender, interrupted, the branches mostly simple. 4. *E. angusta.*
            4. Hypogynous squamellae ciliolate with short hairs which are less than 0.1 mm long; the longest glume 6–8 mm long. 5. *E. longifolia.*
        3. Leaves 2-ranked; body of fructifications ovate-oblong slightly shorter than the ciliae of hypogynous squamellae. 6. *E. disticha.*
    2. Beak of fructifications subulate-conical to subulate or conical, as long as or shorter than the narrowly obovate or ovate-elliptic body.
        8. Hairs of hypogynons squamellae crisped; fructifications 2.25–3 mm long, the beak conical, less than half as long as the body. 7. *E. surinamensis.*
        8. Hairs of hypogynous squamellae straight; fructifications more than 3 mm long, the beak conical-subulate, 1/2 to nearly as long as the body.
            9. Hairs of hypogynous squamellae whitish, scanty; fructifications ovate-elliptic, gradually tapering to beak; inflorescence slender, interrupted, the branches usually simple and short; leaf sheaths wholly disintegrating into dark brown fibers. 8. *E. erecto-laxa.*

9. Hairs of hypogynous squamellae yellowish, copious; fructifications obovate-oblong to obovate, abruptly contracted to beak; inflorescence broader, more or less contiguous, the branches divided, elongate; leaf sheaths brown, disintegrating into reticulate fibers in front only.
  10. Leaf blades elongate, linear, rather flexuous, erect, fascicled.
    11. Leaf blades smooth.
      12. Leaf blades not glaucous. 9a. *E. montana* subsp. *montana.*
      12. Leaf blades glaucous. 9d. *E. montana* subsp. *glaucifolia.*
    11. Leaf blades densely verrucose. 9c. *E. montana* subsp. *duidae.*
  10. Leaf blades short, linear-lanceolate, straight and rigid, spreading often more or less rosette-like.
    13. Leaf blades glabrous, not glaucous. 9b. *E. montana* subsp. *ptariensis.*
    13. Leaf blades puberulent with adpressed short hairs, glaucous. 9e. *E. montana* subsp. *guaiquinimae.*
1. Culms slender and flexuous, shorter than or nearly as long as leaves, bearing spikelets almost from the base; beak of fructifications not conspicuous; stamens 2 or 3 to a flower. Sect. *Pseudo-Everardia.*
  14. Plant not lanate at base, the basal leaf sheaths glabrous.
    15. Plant monoecious; fructifications oblong, acute at apex; leaves glabrous. 10. *E. debilis.*
    15. Plant dioecious; fructifications obovate, contracted to mucronate apex; leaves pubescent with short adpressed hairs. 11. *E. flexifolia.*
  14. Plant densely lanate at base, the basal leaf sheaths thickly pubescent with cottony hairs. 12. *E. lanata.*

Everardia sect. **Everardia.**

1. **Everardia diffusa** T. Koyama & Maguire, sp. nov. Fig. 4, D–E.

Fructum rostro lineari laevissimo, pilis squamellarum hypogynarum crispis et inflorescentia valde diffusa satis cognitur.

Caudex epigaeus obliquus usque ad 15 cm longus 10 mm crassus fibris dilute fuscis molliculis dense vestitus. Folia linearia laete vel flavo-viridia 30–60 cm longa plana rigidula 6–10 mm lata glabra laevia apice sensim longe acuminata, marginibus saepe scabris. Culmi laterales graciles 45–60 cm alti laevissimi basi compressi 2 mm lati 5–8-nodosi. Inflorescentia valde diffusa corymbis partialibus 4 ad 6 constructi contigua; bracteae in vaginas fulvas 6–25 mm longas reductae, laminis anguste setaceis erectis 1–2 (raro ad 4) cm longis; radii 2- ad 5-nati 3–5 cm longi gracillimi patentes fere divisi. Spiculae masculae solitariae raro geminae oblongae 6–8 mm longae stramineo-pallidae; glumae lanceolatae 4–7 mm longae acuminatae. Stamina 3–6; antherae 3–5 mm longae. Spiculae foemineae solitariae 6 mm longae; glumae anguste oblongae 3–4 mm longae 0.5–1 mm latae apice acutae, costa viridi apice in aristam rectam ca. 1 mm longam excurrente. Fructificationes longe exsertae cum rostro 5.5–5.7 mm longae trigonae stramineae glaberrimae a parte propria 2.5 mm longa 1 mm lata oblongo-elliptica in rostrum linearem rectum 3.2 mm longum sensim attenuantes; squamellae hypogynae 0.5 mm longae, lobis rotundis pilis pluribus albo-sericeis valde crispis 1/2 ad 2/3 fructificationis propriae aequilongis ciliatis; stigmata 3, 9 mm longa, brunnea.

Type. West Peak Cano, infrequent among rocks, alt. 1200 m, Cerro Sipapo, Amazonas, Venezuela, *Bassett Maguire & Louis Politi 27825* (NY, holotype).

Paratype. Bolívar, Chimantá Massif, Torono-tepuí, vicinity of Lower Falls of Río Tirica, on northwest side of falls, alt. 1000–1090 m, *Steyermark & Wurdack 1279.*

Distribution. Known only by the cited specimens.

This is distinct from any other species of the genus by the quite glabrous fructifications with linear long beak, the long-crisped ciliae of hypogynous

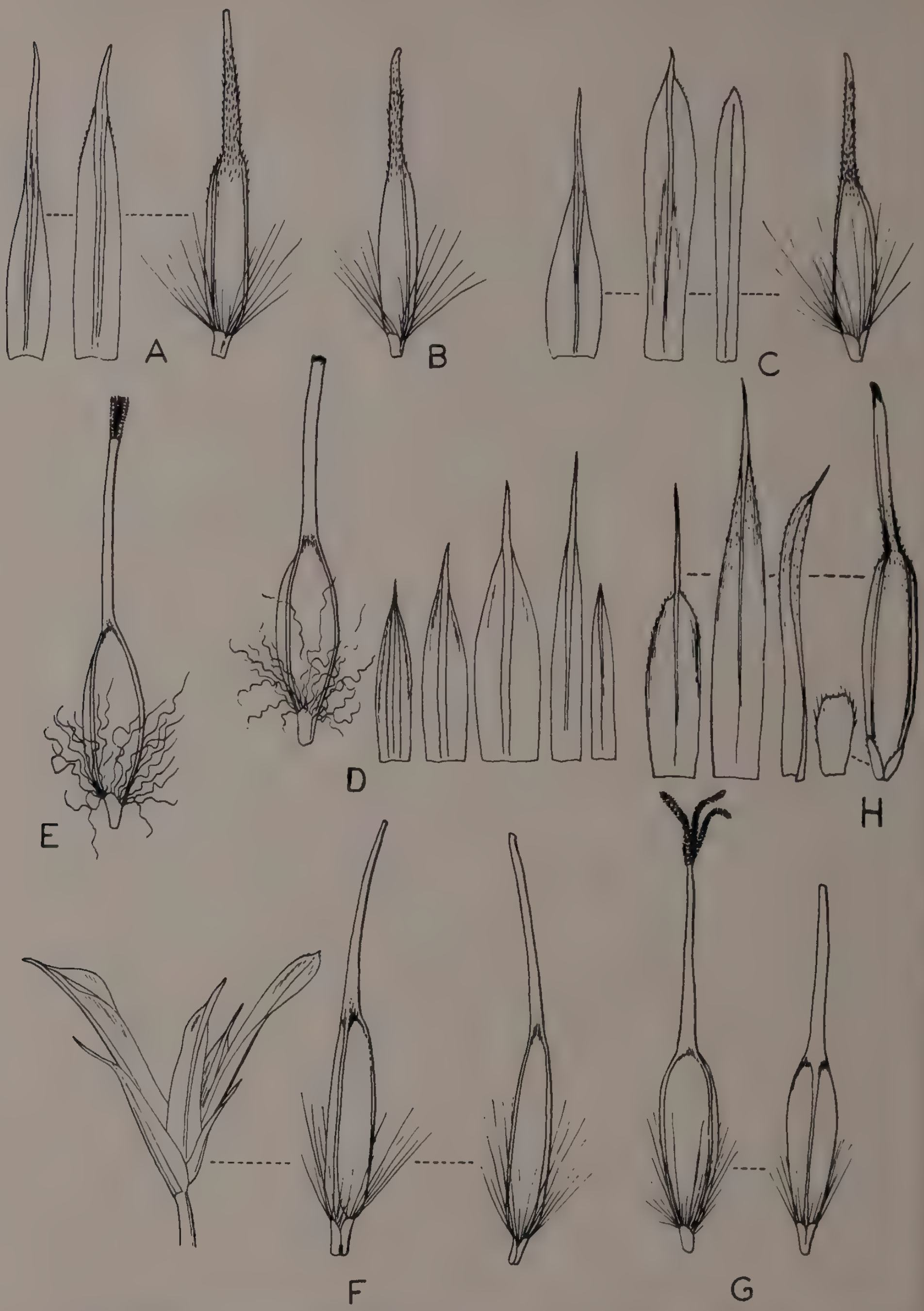

FIG. 4. Glumes and fructifications in *Everardia* (1). *E. vareschii:* A–B, from *Steyermark 656;* C, from *Vareschi & Foldats 4881* (type). *E. diffusa:* D–E, from *Maguire & Politi 27825* (type). *E. recurvigluma:* F, from *Steyermark & Wurdack 1222;* G, from *Maguire 33525* (type). *E. longifolia:* H, from *Steyermark 93703.* Glumes and fructifications × 9.

squamellae, and the very diffuse inflorescence with solitary spikelets on long capillary peduncles. Two specimens from very remote localities well agree with one another.

2. **Everardia recurvigluma** T. Koyama & Maguire, sp. nov. Fig. 4, F–G.

Differt a specie praecedente fructificationibus angustioribus, ciliis squamellarum hypogynarum rectis et glumis maturitate recurvis. Habitu ut videtur illae *E. montana* similis, cum ea tamen nunquam confusa fructificationibus linearioblongis glaberrimis, rostro lineari, ciliis squamellarum hypogynarum longioribus albidis et glumis maturiate apice valde recurvis.

Caudex epigaeus simplex erecto-ascendens 5–20 cm longus 5–10 mm crassus fibris mortuorum vaginarum purpureofuscis crasse vestitus. Folia multa patentia linearia dimidio culmi aequantia longiorave 20–30 cm longa (3–)6–11 mm lata planiuscula vel plicata tenacia supra flavoviridia subtus subconcolora ad costam marginesque pubescentia apice sensim acuta; vaginae brunneae in fibris reticulatim solutae. Culmi rigidi 25–50 cm alti compressi laeves 1.8–2.5 mm lati supra basin vaginam unicam vacuam fusco-brunneam gerentes. Inflorescentia subcontigua paniculis partialibus 3–5 constructa; rami ex unico nodo 3- ad 7-nim fasciculati ramosi usque ad 15 cm longi; bracteae anguste lineares setaceaeve 1.5–2.5 cm longae erectae, vaginis compressis fuscobrunneis 1.2–2.5 cm longis, ore antice contraligulam ferrugineam ovato-deltoideam puberulentem productis. Spiculae masculae singulae interdum geminae ovato-oblongae ferrugineo-brunnescentes 6–7 mm longae; glumae inferiores vacuae ovato-oblongae apice acuminatae vel breviaristatae; glumae superiores staminiferae oblongae 4.5–5.5 mm longae aristam 0.5 mm longam subsensim desinentes; stamina 6, antheris 3.5 mm longis. Spiculae foemineae solitariae maturitate subturbinatae stramineo-fuscae; glumae 5–6 ovato-lanceolatae vel lanceolateae 4–5.5 mm longae maturitate recurvae patentesve apice subsensim brevicuspidatae. Fructificationes glumas longe excedentes lineari-lanceolatae 4.8–6 mm longae ex toto glaberrimae a parte propria lineari-oblonga trigona stramineo-brunnea in rostrum lineari-subulatum brunneum 3.25 mm longum sensim attenuantes; squamellae hypogynae 0.5 mm longae minimae rotundo-deltoideae pilis multis rectis 2 mm longis albescentibus longe ciliatae; stigmata 3, 1.75 mm longa fusco-papulosa.

Type. Upper escarpment at alt. 2400 m, common at base of cliffs, Ilu-tepuí, Bolívar, Venezuela, 20 March 1952, *Bassett Maguire 33525* (NY, holotype). Paratypes. VENEZUELA. Bolívar, Chimantá Massif: Torono-tepuí, west side of Middle Falls of Río Tirica, alt. 1760 m, *Steyermark & Wurdack 1222*, central section, along Río Tirica, below upper falls, alt. 1940 m, *Steyermark & Wurdack 608;* Sierra de Lema, 80 km SE of El Dorado, alt. 650 m, crevices north-facing sandstone escarpment of Río Chicanán, *Steyermark 89638;* Mt. Roraima, below waterfall spray among boulders, 2255–2620 m, *Steyermark 58767;* Caroní, Aprada, alt. 1850 m, *Cardona 1988.*

Distribution. Known only by the cited specimens.

Superficially, this species resembles *E. montana,* with which, however, it has no close relationship. The entirely glabrous linear-oblong fructifications, the copious ciliae of hypogynous squamellae, and the membranous pistillate glumes recurved at maturity comprise features of its own.

3. **Everardia vareschii** Maguire, Act. Biol. Venez. **2**(6): 43. 1957.

Type. Auyán-tepuí, 2300 m, Bolívar, Venezuela, *Vareschi & Foldats 4881* (NY).

Distribution. VENEZUELA. Bolívar: Cumbre of Auyán-tepuí, Alto Caroní, alt. 2500 m, *Cardona 2649;* Chimantá Massif, Torono-tepuí, alt. 2165–2180 m, escarpment in and among zanjones, *Steyermark & Wurdack 656.*

This species can easily be recognized by large diffuse oblong inflorescences exserted from short leaves, and differs from *E. angusta* by the broader leaves and narrower fructifications as illustrated in Fig. 4, A–C.

4. **Everardia angusta** N. E. Brown, Trans. Linn. Soc. II, **6**: 73. 1901.

Cryptangium stamineum N. E. Brown ex C. B. Clarke in Kew Bull. Add. Ser. **8**: 135. 1908. nomen nudum.
Everardia gracilis Gilly, Bull. Torrey Club **68**: 26, *f. 2 b–b'*. 1941. Syn. nov.
Everardia steyermarkii Gilly, Fieldiana Bot. **28**(1): 55. 1951. Syn. nov.

Type. Mt. Roraima, summit, 8600 ft, British Guiana, *McConnell & Quelch 676* (K, holotype; NY, photo).

Distribution. BRITISH GUIANA. Mt. Roraima, summit, struggling, 18 in. tall, *Tate 426* (NY, holotype of *E. gracilis*); ditto, summit, *Tate 425.* VENEZUELA. Bolívar: La Gran Sabana, Ptari-tepuí, *Brocchinia-Stegolepis-Heliamphora* swamp on southwest-facing shoulder, alt. 2200 m, common, *Steyermark 59781* (F, holotype of *E. steyermarkii;* NY, isotype and photo).

After careful comparisons we are convinced that both *E. gracilis* Gilly and *E. steyermarkii* Gilly are identical with *E. angusta* N. E. Brown, one of the historical species of the genus. *E. gracilis* and *E. angusta* have been described from the summit of Mt. Roraima. Gilly's basis for segregating *E. gracilis* from the latter was in the pubescence of fructification. According to him, in *E. gracilis* fructifications are hairy only on the beak, whereas in *E. angusta* they are hairy both on the beak and on the body. In our observations, however, this does not hold true. The body of fructifications of *E. angusta* is in reality not hairy at all but is glabrous like that of *E. gracilis.* In *Everardia,* the bodies of fructifications, which were termed ''ovary'' by Gilly, are small and are completely hidden by the hypogynous squamellae at anthesis. They may easily be overlooked until they develop rather rapidly after pollination. But the beaks of fructifications, which are in many cases pubescent, complete growth by anthesis and are not remarkably elongated after pollination (compare figure C with B in Fig. 5). The specimens studied by N. E. Brown and Gilly have flowering spikelets only and seem to have puzzled these authors. Gilly's basis for creating *E. steyermarkii* was that it was from Ptari-tepuí whereas *E. angusta* and *E. gracilis* are from Mt. Roraima. He failed to credit any morphological difference and admitted that his species resemble the two taxa mentioned above.

5. **Everardia longifolia** Gilly ex Gleason & Killip, Brittonia **3**: 153. *f. 2 g–h.* 1939. Fig. 4, H.

(Descr. emend.) Fructificationes lineari-oblongae 7.75–8 mm longae 0.8 mm latae obscure trigonae costis 3 distinctis maturitate fulvobrunneae, parte propria vere oblonga apice pubescente et in rostrum subito contracta, rostro 3.2–3.5 mm longo subulato basin versus puberulente. Squamellae hypogynae 3 obovato-ellipticae circ. 0.8 mm longae apice obtusiusculae margine superne pilis brevissimis ciliolatae.

Type. Auyán-tepuí, Bolívar, Venezuela, *G. H. H. Tate 1347* (NY, holotype).

Distribution. Endemic to the mountain range along Alto Río Caroní. VENEZUELA. Bolívar, Chimantá Massif: Central Section, swampy depression in wet savanna along east branch of Río Tirica, alt. 2120 m, *Steyermark & Wurdack 791;* central section, on large rock bordering savanna above summit camp, alt. 1940 m, *Steyermark & Wurdack 407;* Torono-tepuí, summit at edge of escarpment in and among zanjones, alt. 2165–2180 m, *Steyermark & Wurdack 628;* Auyán-tepuí, cumbre of the northern part, western division, bordering stream along wet savanna on sandstone exposures, alt. 1660–1800 m, *Steyermark 93703 fr.;* western division, cumbre of the central part, alt. 1800 m, *Steyermark 93482.*

This species has never been collected with mature fructifications, and its taxonomic position has not been determined yet. Steyermark's latest collection, *93703* from Auyán-tepuí, first showed its strikingly large fructifications. As illustrated in Fig. 4, H, they are linear-oblong with a long, subulate beak attaining the length of the body, demonstrating a close affinity between *E. longifolia* and *E. angusta.* The affinity is also suggested by the large floral glumes and loose and almost umbellate partial panicles, which are common in these two species. Nevertheless, *E. longifolia* is distinct by its relatively large, ciliolate hypogynous squamellae, which do not resemble those of any other taxa of *Everardia.*

6. **Everardia disticha** T. Koyama & Maguire, sp. nov. Fig. 5, D–F.

Ab omnibus speciebus *Everardiae* huc usque descriptis foliis conspicue distichis et glumis omnino valde obtusis extus hispidulis facile cognoscenda.

Planta habitu robusta. Caudices epigaei simplices erecti lignosi 50 ad 100 cm alti 15 mm crassi vaginarum mortuorum reliquis fuscis parce fibroso-solutis crasse vestiti. Folia multa dense et spisse disticha praeter margines ciliatas glaberrima oblique patentia 15–30 cm longa 1–2 cm lata valde tenacia plicata subtus pallidiora apice breviter acuta; vaginis 5 cm longis fusco-brunneis. Culmi lateraliter erecti pauci rigidi acipiti 25–60 cm alti 4 mm lati laeves 7-nodosi. Inflorescentia ad 45 cm longa contigua; paniculae partiales luxuriantes nutantes, bracteis in vaginas purpureo-fucas 2.5–3.5 cm longas reducta, laminis angustis erectis ad 15 mm longis, contra-ligulis deltoideis 1.5 mm longis; rami 3–6-nim fasciculati inaequales paniculariter ramulosi multispiculati, bracteolis ca. 1 cm longis fuscis vaginiformibus. Spiculae masculae et foemineae similes omnes solitariae interdum geminae ternaeve oblongae 5–6 mm longae 1–1.5 mm crassae, glumae inferiores ellipticae 2.5–3.5 mm longae, illae superiores oblongae vel oblanceolatae usque ad 4.75 mm longae 0.5–1 mm latae omnes membranaceae brunneae extus versus apicem puberulentes marginibus ciliatae apice rotundae vel leviter emarginatae, costa unica in aristam 0.3–2 mm longam rectam excurrente. Fructificationes glumam excedentes lineari-lanceolatae cum rostro 4.5–5.7 mm longae 0.75–0.9 mm latae obtuse trigonae fuscae a parte inferiore anguste ovata oblongave 1.5–2.2 mm longa in rostrum erectum subulato-linearem 3–4 longum dense fulvo-hipidum sensim transeuntes; stigmatibus 3, ca. 5 mm longis. Squamellae hypogynae 0.3 mm longae ovatae pilis multis albescentibus rectis 2/3 fructificationis pertinentibus longe ciliatae. Stamina 4 ad 6.

Type. Open forest on laterite deposit above swamp following east branch of headwaters of Río Tirica, alt. 2150–2200 m, locally frequent, Chimantá Massif, Bolívar, Venezuela, 12 Feb 1955, *Julian A. Steyermark & John J. Wurdack 808* (NY, holotype; F, US, VEN, isotypes).

Paratypes. VENEZUELA. Bolívar: Uaipan-tepuí, common on the very top

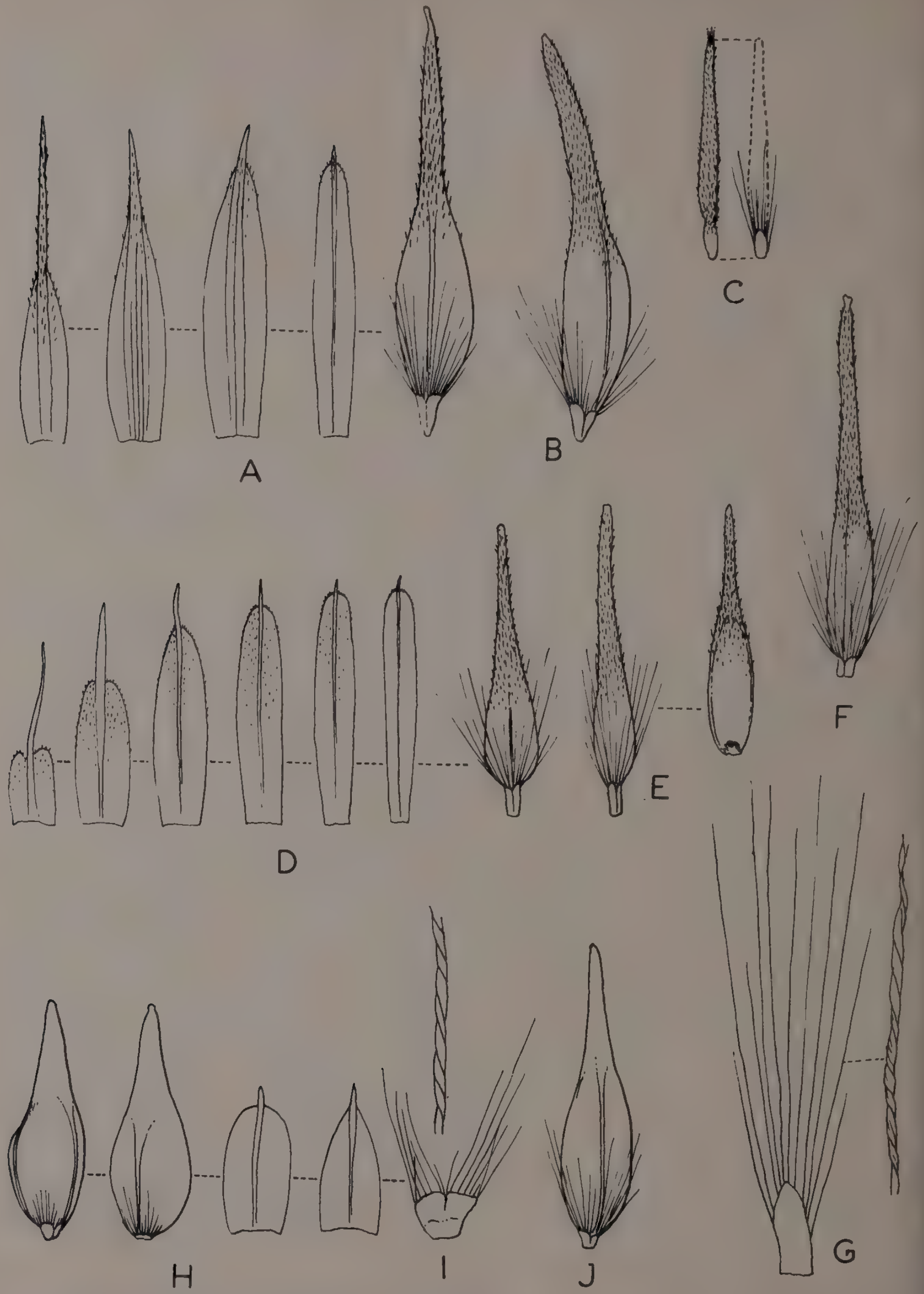

FIG. 5. Glumes and fructifications in *Everardia* (2). *E. angusta:* A–B, from *Steyermark 59781* (isotype of *E. steyermarkii*). C, pistils in flower from *Tate 435. E. disticha:* D–E, from *Phelps & Hitchcock 365;* F, from *Steyermark 808* (type); G, hypogynous squamellae and a part of cilium from *Steyermark 808. E. erecto-laxa:* H–I, from *Maguire 33399* (type); J, from *Maguire 33398.* Mature fructifications and glumes × 9.

at alt. 1900 m, *Phelps & Hitchcock 365;* Mt. Roraima, summit, *Tate 438;* Auyán-tepuí, western division, cumbre of the northern part, Salto Churún, north of Río Churún, alt. 1820 m, *Steyermark 93869* (VEN).

Distribution. Known only by the cited specimens.

This striking taxon is characterized not only by the 2-ranked leaves but also by peculiar features of fructifications and glumes as illustrated in Fig. 5, D–F. The caudex in one of the type collections reaches the height of 1 m.

7. **Everardia surinamensis** Gilly, Bull. Torrey Club **76**: 292. 1949.

Type. Vicinity of Savanna IV, wet places in dense low maka swamp, alt. 520 m, frequent, Tafelberg, Suriname. *Bassett Maguire 24382* (NY, holotype).

Distribution. Reported from several remote localities in the eastern part of the Guayana sandstone area. VENEZUELA. Bolívar: Alto Río Cuyuni, Cerro Uroi, alt. 700–800 m, rare in exposed places at base of north-facing escarpment, *Maguire, Steyermark & C. K. Maguire 53765;* Quebrada Piton, alt. 400 m, Cerro Piton, Cordillera Epicara, *Maguire, Steyermark & C. K. Maguire 53714;* summit of southeast end of Cerro Piton, alt. 400 m, infrequent on dry rocky exposures, *Maguire, Steyermark & C. K. Maguire 53624;* Auyán-tepuí, vicinity of Guayaraca, along Río Guayaraca on sandstone substrate in rocky part of plateau, 1000 m, *Steyermark 94195.* SURINAME: Tafelberg, west escarpment, moist mossy rocks, base of wall, alt. 485 m, infrequent, *Maguire 24679.*

Apparently a new addition to the flora of the State of Bolívar, Venezuela, being previously known from Suriname only. This species superficially resembles *E. montana* but differs clearly from it by the smaller fructifications with shorter and thicker beaks, and the crisped cilia of hypogynous squamellae, a rare character in *Everardia* (Fig. 7, C–E).

8. **Everardia erecto-laxa** T. Koyama & Maguire, sp. nov. Fig. 5, H–J.

E vicinia *E. montanae,* quae dissimilis est fructificationibus ovato-oblongis non obovatis nec obovato-oblongis, ciliis squamellarum hypogynarum paucioribus brevioribusque albis, inflorescentia depauperata ramis brevibus haud divisis valde interrupta et foliis multo angustioribus.

Caudices epigaei erecti erectoascendentesve 15 cm longi 2–4 mm crassi simplices raro divisi fibris atrobrunneis dense vestiti. Folia laxiuscule erecta 12–25 cm longa 2.5–7 mm lata tenuiter coriacea plicato-plana supra laete-viridia subtus dilute flavo-virentia praesertim ad marginem costamque densiuscule pilosa apice sensim longe acuminata. Culmi graciles erecti laeviusculi sed basi puberuli compresso-trigoni 20–50 cm alti 1 mm crassi supra basin vaginam unicam ad 3 cm longam ferentes. Inflorescentia linearis 15–25 cm longa fasciculis 4–5 valde distantibus constructa; rami 3–6-nim inaequaliter erecti 1–4 cm longi simplici spiculis unicis duabusve terminati. Spiculae masculae 4 mm longae elliptico-oblongae virentes; glumae vacuae 4 vel 5 ovatae 2.5–3.5 mm longae aristato-acuminatae, eae staminiferae oblongae 3–3.5 mm longae; stamina ex unico flore 6. Spiculae foemineae 3 mm longae; glumae 6 ovatae 2–2.5 mm longae pallide virentes apice acuminatae vel breviaristatae. Fructificationes anguste ovatae vel ovato-oblongae fere teretes 3.5–5 mm longae 1–1.25 mm latae a parte propria fusco-rubescenti tricostata in rostrum conicum 1.5–2 mm longum fulvum glabrum sensim attenuantes, stigmatibus 3 brunneis. Squamellae hypogynae 0.3 mm longae depreese rotundae pilis albis 0.7–1.5 mm longis sparse pilosae.

Type. Mesa Ridge, frequent in rocky places of open bush, alt. 1950 m, Ilu-tepuí, Bolívar, Venezuela, 13 March 1952. *Bassett Maguire 33399* (NY).

Paratype. Ilu-tepuí, Mesa Ridge at alt. 1950 m, Bolívar, Venezuela, *Maguire 33398* (NY).

Distribution. Known only by the cited specimens and it is so far endemic to Ilu-tepuí.

At a glance this species resembles *E. angusta* particularly in the narrow leaf blades, but the true taxonomic relationship is apparently with *E. montana.* It is differentiated from *E. montana* by the fructifications that are ovate-elliptic vs. obovate-elliptic and by the ciliae of squamellae that are white and scanty vs. yellowish and abundant.

9. **Everardia montana** Ridley ex im Thurn, Timehri (Jour. Roy. Agr. & Comm. Soc. Brit. Guiana) **5**: 210. 1886; Ridley, Trans. Linn. Soc. II, **2**: 287. *t. 52.* 1887.

The *Everardia montana* complex as here interpreted consists of five entities, *E. montana, E. glaucifolia, E. duidae, E. ptariensis* and *E. guaiquinimae.* Detailed comparison made on 241 individuals of 63 collections of the complex revealed that these taxa may be discerned by leaf characters, but otherwise they are very similar to each other on morphological characters that are common in all taxa of the complex. Among the common characters the cilia of the hypogynous squamellae are the most remarkable. With the short yellowish ciliae all taxa of the complex can be sharply distinguished from the rest of the species in *Everardia* having whitish cilia. Figure 6 shows that the fructifications of the complex are consistently obovate to obovate-oblong with a subulate beak that is invariably shorter than the body. They vary to a considerable extent in pubescence and size, but such variation is not correlated at all to other characters and geographical distribution.

The leaf-surfaces as mentioned above are more significant than the characters of fructifications in distinguishing these taxa. Four of the five plants of this complex have individual leaf-surface features. In *E. duidae* leaf blades are verrucose, thick and very weakly involute; in *E. glaucifolia* they are straightish, flat and highly glaucous; in *E. ptariensis* they are rigid, short and spreading as a rosette; in *E. guaiquinimae* they are more or less glaucous and pubescent. The blades in typical *E. montana* are more variable than those of the four others. They are typically recurved, rather thin with more or less revolute margins, and not glaucous at all. In specimens from certain areas, however, the blades show some transitional status. For example, in plants from Cerro Sipapo and Cerro Yutaje the blades tend to be slightly glaucous and flat, and thus approach those of *E. glaucifolia;* in the specimens from Vaupés, Colombia, the blades are glaucous as in *E. glaucifolia* but are flat and soft as in typical *E. montana;* or in plants from Cerro Duida blades tend to be variably or hardly at all verruculose.

Typical *E. montana* has a wide range covering all Venezuelan Guayana from Cerro Sipapo eastwards to Roraima. The ranges of all other taxa of the *E. montana* complex are restricted to very localized spots within the range of typical *E. montana.* When we combine this distributional evidence with morphological data discussed above, there are correlations between distribution and leaf surface feature to some extent. The small taxa in the complex may, therefore, well be considered to be later developments possibly due to the isolation for a long period, whereas typical *E. montana* with broad range and elasticity in morphological

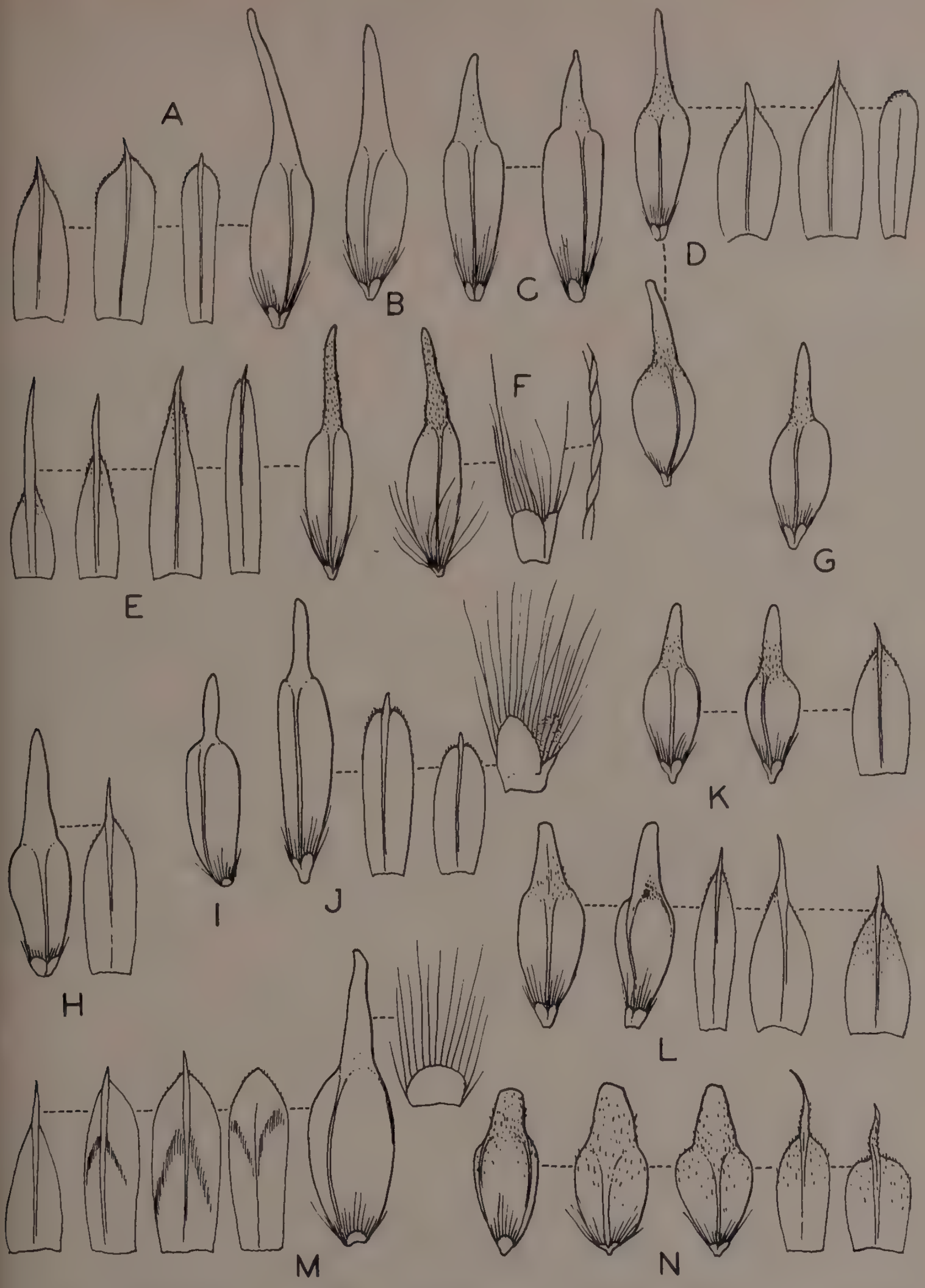

FIG. 6. Glumes and fructifications in *Everardia* (3). *E. montana*-complex. Subsp. *montana:* A, from *Steyermark 410;* B, from *Wurdack 34235;* C, from *Steyermark 74847;* D, from *Phelps & Hitchcock 15* (type of *E. hitchcockii*); E, from *Maguire et al. 29860;* F, from *Tate 469* (type of *E. revoluta*); G, from *Maguire et al. 31640;* K, from *Maguire et al. 30954.* Subsp. *glaucifolia:* H, from *Maguire et al. 30146.* Subsp. *ptariensis:* I–J, from *Steyermark 59496* (type of *E. ptariensis*). Subsp. *duidae:* L, from *Maguire et al. 30077;* N, from *Maguire et al. 37166.* Subsp. *guaiquinimae:* M, from *Maguire 32791.* Glumes and fructifications × 9.

characteristics is assumed to be more closely related to the prototypic feature of the *E. montana* complex. On this basis we regard the four taxa as subspecies of *E. montana* as reinterpreted below.

9a. **Everardia montana** subsp. **montana.**

Everardia revoluta Gilly, Bull. Torrey Club **68**: 28. *f. 3 e–e′*. 1941. Syn. nov.
Everardia hitchcockii Lasser & Maguire, Brittonia **7**: 76. 1950. Syn. nov.
Everardia montana Ridley var. *pilosa* Gilly, Fieldiana Bot. **28**(1): 54. 1951. Syn. nov.

Type. Mt. Roraima, the Ledge [Venezuela]. *im Thurn 335* (K, holotype; NY, photo).

Distribution. This subspecies has the broadest range of distribution in the genus *Everardia*, covering most of the Roraima sandstone sediment from Cerro Sipapo and Cerro Duida eastwards to Ptari-tepuí and Mt. Roraima. It has recently been newly found from the northern part of Peru by Dr. J. J. Wurdack. Following specimens have been examined including the types of synonymous names. PERU. Dep. Amazonas, Prov. Chachapoyas: Jalca zone 1–5 km west of Molinopampa, alt. 2400–2450 m, locally abundant, *J. J. Wurdack 1380* (NY, US). VENEZUELA. Amazonas: Serrania Yutaje, *Maguire & Maguire 35210, 35326 & 35403;* Cerro Yaví, *Phelps & Hitchcock 2, 15* (NY, holotype of *E. hitchcockiana*) and *71;* Cerro Sipapo, *Maguire & Politi 27529, 27599, 27701 & 28468;* Serranía Parú, *Cowan & Wurdack 530;* Cerro Yapacana, *Maguire, Cowan & Wurdack 30681 & 30954;* Cerro Huachamacari, *Maguire, Cowan & Wurdack 29860 & 29883;* Cerro Guaviarito, *Maguire, Phelps, Hitchcok & Budowski 31640, 3177a & 31816;* Cerro Duida, *Tate 469* (NY, holotype of *E. revoluta,* from crest of Ridge 25 at alt. 6300 ft) and *816*. Bolívar: Cerro Guaiquinima, *Maguire 32890, 33086;* Mt. Roraima, *im Thurn 335* (K, holotype of *E. montana;* NY, photo), *McConnell & Quelch 674* (K). BRITISH GUIANA: Pakaraima Mts., *Maguire & Fanshawe 32548.*

The specimens from northern Peru agree well with a narrow-leaved form of *E. montana* subsp. *montana* of Guayana. The phytogeographical significance of this interesting discovery is still waiting the accumulation of floristic data from the station in northern Peru and the adjacent foothills of the Andes.

9b. **Everardia montana** subsp. **duidae** (Gilly) T. Koyama & Maguire, stat. nov.

Everardia duidae Gilly, Bull. Torrey Club **68**: 30. *f. 3 g–g′*. 1941.
Everardia neblinae Metcalfe, Advances in Bot. Res. ed. Preston, **1**: 124, 132 & 133. 1963. nomen nudum.

Type. Summit of Mt. Duida, 7100 ft, Amazonas, Venezuela, *G. H. H. Tate 638* (NY).

Distribution. This subspecies occurs in the southeastern portion of the range of subsp. *montana*. VENEZUELA. Amazonas, Cerro de la Neblina: frequent in openings and open woodlands, vicinity of Summit Camp at alt. 1800 m, *Maguire, Maguire & Wurdack 42108,*[13] abundant in savannas of West Escarpment at alt. 1700–1800 m, *Maguire, Wurdack & Bunting 37166,*[13] occasional in open woodland, escarpment overlooking Cañon Grande, alt. 1650 m, *Maguire, Wurdack & Bunting 37209,* savanna, West Escarpment at alt. 1750 m, *Maguire, Wurdack & Bunting 37151-A;* Cerro Huachamacari: SW escarpment at alt. 1850 m, frequent, *Maguire, Cowan & Wurdack 30289 & 30290,* summit, East Ridge No. 1, at alt. 1820 m, frequent, *Maguire, Cowan & Wurdack 30077,* occasional along West Escarpment at alt. 1800 m, *Maguire, Cowan & Wurdack 30219;* Bolívar: Salto Ichun, 4° 46′ N and 63° 18′ W, on uppermost sandstone bluffs in shade, *Steyermark 90226.*

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[13] Intermediate between subsp. *montana* and subsp. *duida* with rather inconspicuously verrucose blades.

9c. **Everardia montana** subsp. **glaucifolia** (Gilly) T. Koyama & Maguire, stat. nov.

Everardia glaucifolia Gilly, Bull. Torrey Club 68: 27. *f. 2 d–d′.* 1941.

Type. Mt. Duida, summit, Ridge, northwest of Vegas Brook, alt. 4400 ft, Amazonas, Venezuela, *G. H. H. Tate 570* (NY).

Distribution. This subspecies occupies the western portion of the range of subsp. *montana.* COLOMBIA. Vaupés: Río Kananari (affluent of Río Apaporis), Cerro Isibukuri, alt. 2500 ft, *Schultes & Cabrera 14732* (US), Rio Kananari and Cerro Isibukuri, alt. 250 m, *H. Garcia-Barriga 13794* (US). VENEZUELA. Amazonas: Cerro Sipapo, Savanna Grande at alt. 1500 m, common in wet pockets, *Maguire & Politi 27528;* Cerro Huachamacari: Southeast Escarpment at alt. 1900 m, marshy scrub savannas, *Maguire, Cowan & Wurdack 30146,* abundant in marshy area at East Escarpment, alt. 1950 m, *Maguire, Cowan & Wurdack 30257,* wet boggy places at East Escarpment at alt. 1950 m, *Maguire, Cowan & Wurdack 30257-A;* Cerro Guanay, frequent in marshy area, Cumbre at alt. 1800 m, *Maguire, Phelps, Hitchcock & Budowski 31708;* Cerro Duida, summit, Ridge NW of Vegas Brook, alt. 4400 ft, *Tate 570.* Bolívar: Chimantá Massif: Central Section scrub forest near Cumbre Camp, at alt. 1925 m, frequent, *Steyermark & Wurdack 349,* Central Section, swamp savanna along west branch of headwaters of Río Tirica above Upper Falls, alt. 2090 m, locally frequent, *Steyermark & Wurdack 902;* Cerro Guaiquinima, vicinity Cumbre Camp at 1800 m alt., marshy area, savannas, *Maguire 32791.*[14]

9c. **Everardia montana** subsp. **guaiquinimae** (Schnee) T. Koyama & Maguire, stat. nov.

Everardia guaiquinimae Schnee, Bull. Soc. Venezolana Sci. Nat. 9: 83. 1944.

Type. Cerro Guaiquinima, alt. 1740 m, Bolivar, Venezuela, *Cardona 974* (VEN, holotype; NY, US, isotypes).

Distribution. Endemic to Cerro Guaiquinima: Alto Río Paragua, alt. 1760 m, *Cardona 1119* (NY, US, VEN); West Rim at alt. 1800 m, juvenile plant among rocks, boggy place, *Maguire 32826;* North Valley, alt. 1600–1700 m, common in open boggy savanna, *Maguire 33051;*[15] West Rim at alt. 1800 m, occasional in drier place on rocks and under thickets, *Maguire 32837.*

The border between subsp. *guaiquinimae* and subsp. *glaucifolia* is obscured by the two intermediate specimens, *Maguire 32791* and *Maguire 33051,* both from the Cerro Guaiquinima. In no. *32791* the leaves are rigid and short with very blunt apex like those of subsp. *guaiquinimae,* but the surfaces of blades are glaucous and glabrous as in subsp. *glaucifolia.* In *33051* the leaves are pubescent as in subsp. *guaiquinimae* but are also elongate, erect and not very rigid like those of subsp. *glaucifolia*. They are here referred to subsp. *glaucifolia* and subsp. *guaiquinimae*, respectively, because of the feature of the leaf surfaces.

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[14] Intermediate between subsp. *glaucifolia* and subsp. *guaiquinimae.*

[15] Intermediate between subsp. *glaucifolia* and subsp. *guaiquinimae.*

9e. **Everardia montana** subsp. **ptariensis** (Gilly) T. Koyama & Maguire, stat. nov.

Everardia ptariensis Gilly, Fieldiana Bot. 28(1): 55. 1951.

Type. Ptari-tepuí, on forested south-facing slopes overlying sandstone on "Cave Camp," alt. 1810 m, *J. A. Steyermark 59496* (F, holotype; NY, isotype and photo).

Distribution. This subspecies occurs in the very limited eastern portion of the range of subsp. *montana*. VENEZUELA. Bolívar: Chimantá Massif: Churi-tepuí, Camp 8 at alt. 2050 m, northeast Cumbres, frequent on escarpment face, *Wurdack 34235;* on large rock bordering savanna above summit camp at alt. 1940 m, locally frequent in exposed places, *Steyermark & Wurdack 408, 409 & 410; Bonnetia* forest, northwestern part of summit of Abacapa-tepuí, alt. 2125–2300 m, open sandstone outcrops, *Steyermark 74847;* Auyán-tepuí, upper part, locally abundant, *Vareschi & Foldats 4893.*

Everardia sect. **Pseudo-everardia** (Gilly) T. Koyama & Maguire, stat. nov.

Pseudo-everardia Gilly, Fieldiana Bot. 28(1): 59. 1951. pro genere.

Descr. emend. Fructificationium rostra plus minus inconspicua vel brevissima basi in partem propriam sensim transeuntia. Stamina 2 raro 3. Plantae dioecae vel monoicae; culmi graciles a basi ad apicem spiculigeri; folia tenuia in sicco brunneo-rubentia itaque habitus istae *Cephalocarpi* simulans.

Type species. *Pseudo-everardia flexifolia* (Gilly) Gilly [= *Everardia flexifolia* (Gilly) T. Koyama & Maguire].

10. **Everardia debilis** T. Koyama & Maguire, sp. nov. Fig. 7, A–B.

Ab *E. flexifolia* habitu monoica et fructificationes oblongis apice inconspicue rostratis non mucronatis distincte recedit.

Caudices epigaei erecti usque ad 5 cm longi 1.2 cm lati fibris brunneis vestiti. Folia multa dense caespitosa linearia flexuosa plerumque plicato-plana 1.5–6 mm lata culmum paullo superantia vel aequantia 20–32 cm longa glabra tenuiter coriacea apice gradatim longe acuminata. Culmi plures graciles intra folia absconditi 1–1.3 mm crassi glabri laeves supra basin ad apicem laxe sed contiguiter spiculigeri 3- ad 5-nodosi. Inflorescentia fasciculis 3 ad 5 fere contiguis constructa apice nutans; bracteae in vaginas castaneas 6–15 mm longas reductae, laminis rectis lanceolatis tantum 3–6 mm longis; radii capillares 3- ad 5-nati aut simplices aut ramosi cernui spiculis solitariis geminisve terminati. Spiculae masculae oblongo-lanceolatae dilute fuscae 4–5 mm longae 1–1.5 mm latae; glumae 2–3.8 mm longae cuspidatae tenuiter membranaceae; stamina 2. Spiculae foemineae maturitate turbinatae; glumae 7 ovatae usque oblongo-lanceolatae 2–4 mm longae membranaceae versus apicem contractae ciliataeque, costa unica in cuspidem 0.5 mm longum excurrente. Fructificationes ellipticae vel lanceolato-oblongae 3–4.2 mm longae 0.8–1 mm latae trigonae facie fuscescentes adpresse puberulentes apice in rostrum brevissimum subulato-conicum 1/2–2/3 mm longum sensim desinentes, stigmatibus 3. Squamellae hypogynae ovato-deltoideae

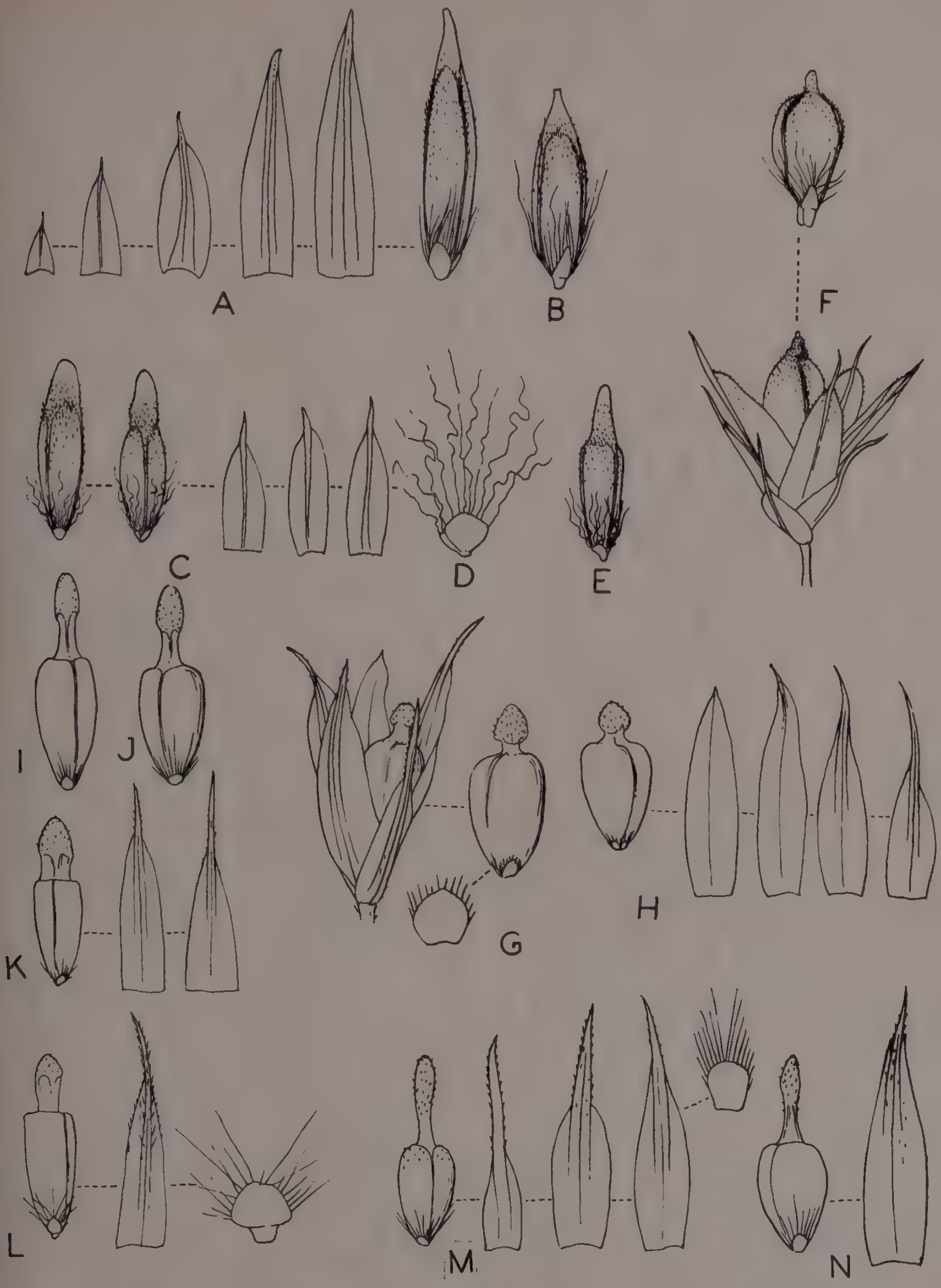

FIG. 7. Glumes and fructifications of *Everardia* and *Cephalocarpus*. *Everardia* (*Pseudoeverardia*) *debilis:* A, from *Maguire & Maguire 35156* (type); B, from *Maguire et al. 31735*. *E. surinamensis:* C–D, from *Maguire 24382* (isotype); E, from *Maguire 53624*. *E.* (*Pseudoeverardia*) *flexifolia:* F, from *Maguire et al. 29085*. *C. dracaenula:* G–H, from *Schultes 16305*. *C. confertus:* K–L, from *Maguire 33394*. *C. rigidus:* I, from *Tate 721* (type of *C. rigidus*); J, from *Maguire 27826;* M, from *Steyermark 59640* (isotype of *C. steyermarkii*); N, from *Tate 1345* (type of *C. lineariifolius*). Glumes and fructifications × 9.

0.5 mm longae pilis pluribus sericeis albis flexuosis 1/3 ad 1/2 fructificationis aequilongis ciliatae.

Type. Northwest Ridge at alt. 1400 m, perennial sedge among dry rocks and boulders, common in scrub bush, Cerro Yutaje, Amazonas, Venezuela, 11 Feb 1953, *Bassett Maguire & Celia K. Maguire 35156* (NY, holotype).

Paratypes. Cerro Yutaje, Left Fork, Caño Yutaje at alt. 1250 m, frequent along streamside, *Maguire & Maguire 35229;* Cerro Guanay, frequent, Cumbre at alt. 1800 m, *Maguire & Maguire 31735.*

Distribution. Known only by the cited specimens.

11. **Everardia flexifolia** (Gilly) T. Koyama & Maguire, comb. nov. Fig. 7, F.

Didymiandrum flexifolia Gilly, Bull. Torrey Club **68**: 331. 1941.
Pseudo-everardia flexifolia (Gilly) Gilly, Fieldiana Bot. **28**(1): 59. 1951.

Type. Summit of Mt. Duida, 4800 ft, Amazonas, Venezuela, *G. H. H. Tate 542* ♂ (NY, holotype of *Didymiandrum flexifolium* Gilly).

Distribution. Southern Guayana. VENEZUELA. Amazonas, Cerro Duida: Culebra Peak, occasional in rocky places, alt. 1600 m, *Maguire & Maguire, Jr. 29085* ♂, ♀; Culebra to Cumbre Camp, alt. 1400 m, tufted in rock crevices, frequent along ridge trail, *Maguire, Cowan & Wurdack 29528* ♂; open slopes of Culebra Peak at alt. 1800 m, occasional, *Maguire & Maguire, Jr. 29127* ♂; Caño Culebra, alt. 1000–1100 m, rocky places, *Maguire, Cowan & Wurdack 29513* ♂; Brocchinia Hills, alt. 1700–1980 m, common as ground cover on dry slopes, *Steyermark 58194-A* ♀, *58194-B* ♂ (F).

We regard *Pseudo-everardia* as a section of the genus *Everardia.* When Gilly proposed this group at the generic status he based it mainly on its dioecious habit. But, such sexual character is not sufficient for distinguishing genera in the tribe Lagenocarpeae because it merely shows an evolutionary tendency from monoecism to dioecism, inasmuch as several other monoecious species of the tribe tend to be dioecious. Furthermore, both dioecious and monoecious types are found even in the same species as in the *Lagenocarpus rigidus* complex. *Everardia debilis* as described above is monoecious but is definitely more closely related to *E.* (*Pseudo-everardia*) *flexifolia* than to any other species of the tribe. In *Pseudo-everardia* narrow leaves and slender culms that turn brownish-reddish when dried suggest an affinity with *Cephalocarpus,* but the characteristic fructification clearly places *Pseudo-everardia* in the genus *Everardia.* The fructifications of *Pseudo-everardia* without cavities around the style-bases separate *Everardia* in extended sense from *Cephalocarpus.*

12. **Everardia lanata** T. Koyama & Maguire, sp. nov.

Ab omnibus speciebus *Everardiae* caudicibus et vaginis basilaribus copiose lanatis valde distat.

Planta dioeca. Caudices breves divisi reliquis vaginarum mortuorum et lanis albo-flavescentibus copiosis crasse vestiti; radicibus crassiusculis. Folia anguste linearia ad 30 cm longa 2 mm lata plus minus revoluta margine utrinque albo-pilosa apice gradatim angustata acuta; vaginae dense lanata. Culmi laterales ex axilla foliorum orti intra folia absconditi 20–23 cm alti graciles laeviusculi infra medium ad apicem spiculigeri. Inflorescentia paniculato-fascicularis interrupta 3–5-nodosa; paniculae partiales 3–5 paniculato-crymbosae, ramis gracilibus 5–9-nis valde inaequalibus fasciculatae, ramis ramulisque albo-pubescentibus; bracteae inferiores inflorescentiam superantes. Spiculae masculae oblongae usque oblongo-ellipticae circiter 2 mm longae; glumae imbricatae ovatae vel ovato-oblongae membranaceae fulvae inferiores 1 ad 3 vacuae caeterae staminiferae apice breviter acutae, paucinervosae margine superne ciliatae; stamina 2. Spiculae foemineae ellipticae 1-florae 2 mm longae; glumae ellipticae vel ovato-oblongae margine pilis longiusculis ciliatae. Fructificationes (immaturae) ovato-ellipticae trigonae spice brevirostratae, stigmatibus 3, stylo brevissimo fere nullo.

Type. Rio Kananari and Cerro Isibukuri, alt. 250–700 m, Vaupés, Colombia, 29–30 Nov 1951, *H. Garcia-Barriga 13811* (NY, holotype; COL, K, US, isotypes). Paratype. COLOMBIA. Vaupés, Cerro Isibukuri, Piedra de arenisca, alt. 250–ca. 700 m, hanging on cliff, *R. E. Schultes & Isidro Cabrera 13357* (NY, US).

Distribution. Known only by the cited specimens.

This striking species because of its lanate caudex does not resemble any other species of the genus. Lanate caudices of this kind are often seen in the section *Imberbitae* of *Lagenocarpus*, but the lateral flowering culms arising from the axils of the lower leaves of the caudex demonstrate this to be a species of *Everardia*. Mr. Garcia-Barriga, the collector of the type specimen, kindly sent us a photograph and ecological note of the type locality. The note shows that *E. lanata* grows on bare escarpments. This habitat is characteristic of *Everardia* but not of *Lagenocarpus*. By its fructification with a short conical beak, the nature of cilia of leaves, and by the dioecism, this species is assigned to the section *Pseudo-everardia*.

Lagenocarpus Nees, Linnaea **9**: 304. 1834.

Anogyna Nees in Hooker, Jour. Bot. 2: 395. 1840.
Acrocarpus Nees, Fl. Bras. 2(1): 157. 1842. Non Wight & Arn. (1839).
Cryptangium Schrader ex Nees, Fl. Bras. 2(1): 163. 1842.
Microlepis Schrader ex Nees, Fl. Bras. 2(1): 163. 1842. Nomen invalidum ex synonymis.
Phaenopyrum Schrader ex Nees, Fl. Bras. 2: 165. 1842. Nomen invalidum ex synonymis.
Adamantogeton Schrader ex Nees, Fl. Bras. 2: 166. 1842. Nomen invalidum ex synonymis.
Orobium Schrader ex Nees, Fl. Bras. 2: 166. 1842. Nomen invalidum ex synonymis.
Lerisca Schlechtendal, Bot. Zeit. 3: 476. 1845.
Cryptanguina Lindley, Veg. Kingd. 119. 1847.
Cladotheca Steudel, Syn. Pl. Glumac. 2, 178. 1855.

Plants monoecious or dioecious, perennial with short rhizomes sometimes with elongated stolons. Culms central, erect, triquetrous, several-noded, phyllopodic or aphyllopodic. Leaves with a linear blade, those of aphyllopodic species reduced to bladeless cataphylls toward the base of culms; sheaths long; contra-ligules produced, rounded-deltoid. Inflorescence consisting of several to many partial inflorescences, interrupted or more or less contiguous; partial inflorescences compound-paniculate, fascicled or more or less umbelliform, in monoecious plants the lower ones staminate and the apical ones pistillate. Staminate spikelets oblong-ellipsoid, many-flowered, single or clustered, sometimes congested in dense glomerules. Stamens 1 or 2 (sometimes up to 6) to a flower. Pistillate spikelets 1-flowered, single rarely paired at apex of peduncle; glumes imbricate, 5–7 or 3 to a spikelet. Fructifications trigonous, sometimes beaked, sometimes stipitate, smooth or foveolate rarely hispidulous, the utricle completely adnate to the achene; stigmas 3 (rarely 4 or more); hypogynous squamellae as a rule 3, minute, ciliolate, rarely needle-like.

Type. *Lagenocarpus guianensis* Lindley & Nees.

This genus is characteristically heterogeneous. H. Pfeiffer (1922)[16] divided the genus into four sections chiefly based on the number of staminate flowers in a staminate spikelet and the manner of branching in partial inflorescences. We cannot agree with his classification. To our knowledge, the number of staminate flowers in a spikelet varies to some extent within a single species but does not vary appreciably between different species. The manner of branching shows a tendency to vary from paniculate to fasciculate branching, but this is insufficient for separating sections. Critical points for separation are in the structure of fructifications, the number of glumes in a pistillate spikelet, the type of pubescence of basal sheaths, and the feature of leaves especially whether they are radical or cauline. Species with stipitate fructifications always have pistillate spikelets with three glumes, whereas those with sessile fructifications always have pistillate spikelets with more than five glumes. The former are assigned to *Acrocarpus,* and can be further divided into two small groups by leaf arrangement. The latter also consist of two groups, which are characterized by different features of fructifications and inflorescences. The four sections that are thus regarded to represent natural groupings, may be classified as designated in the following key. Pfeiffer's names, retained for these sections, are largely accordingly amended.

Key to the Sections of *Lagenocarpus*

1. Fructifications sessile, ovoid, ellipsoid or subglobose, tri-sulcate or very obtusely ridged; pistillate glumes 5 to 7 to a spikelet.
    2. Fructifications with a conspicuous beak at apex, the beak conical or mucro-like; inflorescence decompound with many secondary and tertiary branchlets, ample, rather contiguous with numerous spikelets. Sect. *Lagenocarpus.*
    2. Fructifications abruptly contracted to apex without any conspicuous beak; inflorescence compound, semicompound or simple, the secondary branchlets few or none, the partial inflorescences distant, with rather many spikelets. Sect. *Imberbitae.*
1. Fructifications stipitate, obovoid or oblong-obovoid, tri-costate with sharp ridges; pistillate glumes 3 to a spikelet.
    3. Culms phyllopodic, i.e., radical leaves with long blade. Sect. *Corymbosae.*
    3. Culms aphyllopodic, i.e., the basal part of culms for a considerable length clothed with a few bladeless cataphylls only, and leaves with elongate blade all congested toward the apices of culms. Sect. *Acrocarpus.*

Lagenocarpus sect. **Lagenocarpus.**

Sect. *Cladioides* H. Pfeiffer in Fedde, Repert. Sp. Nov. **18**: 73. 1922.
Sect. *Paucistachyae* H. Pfeiffer in Fedde, Repert. Sp. Nov. **18**: 86. 1922. E majore parte incl. typum, *L. tenuifolium.* Syn. nov.

Type. *Lagenocarpus guianensis* Lindley & Nees (type of the genus).

Pfeiffer's section *Paucistachyae* includes four species, *L. lapaensis, L. tenuifolius, L. inversus,* and *L. triqueter.* All except the last are identical and are considered to be conspecific with *L. rigidus* of the section *Lagenocarpus.* The original description of *Paucistachyae,* "Spiculae foemineae terminali longe pedunculatae fasciculatae . . . paniculis masculis percompositis. . . . Nux tri- interdum quinque-sulcata . . . ," apparently covers the characters of the first three species. *L. tenuifolius* is here chosen for the type species of the section *Paucistachyae.*

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[16] Pfeiffer, H. Additamenta ad cognitionem generis Lagenocarpus III. *In* Fedde, Repert. Sp. Nov. **18**: 72–93. 1922.

Key to Species of the Sect. *Lagenocarpus*

1. Beak of fructifications thickly conical, glabrous; pistillate glumes shorter than the fructification, chartaceous; pistillate spikelets upright on rigid erect peduncle.
  2. Fructifications foveolate or rugulose, the body abruptly contracted into a beak.
    3. Leaf blades flat, broadly linear, 5–17 mm wide; inflorescence dense.
      4. Radical leaves not septate-nodose, the blades curled. 1a. *L. rigidus* subsp. *rigidus.*
      4. Radical leaves septate-nodulose, the blades not curled. 1b. *L. rigidus* subsp. *tremulus.*
    3. Leaf blades involute, narrowly linear, less than 5 mm wide; inflorescence loose. 1c. *L. rigidus* subsp. *tenuifolius.*
  2. Fructifications smooth or nearly so, the body gradually tapering into a beak.
    5. The body of fructifications with three brown patches; leaf blades puberulent at least when young. 2. *L. sabanensis.*
    5. The body of fructifications without patches; leaf blades quite glabrous.
      6. Hypogynous squamellae minute, ovate-deltoid; inflorescence with rigid divaricate branches, very dense. 3a. *L. guianensis* subsp. *guianensis.*
      6. Hypogynous squamellae needle-like, as long as the body of fructifications; inflorescence with rather flexuous erect or patent branches, less dense. 3b. *L. guianensis* subsp. *hypochaetus.*
1. Beak of fructifications short-cylindrical, hispidulous; pistillate glumes as long as the fructifications, membranous; pistillate spikelets pendulous on weak filiform peduncle. 4. *L. pendulus.*

1. **Lagenocarpus rigidus** (Kunth) Nees, Fl. Bras. **2**(1): 167. 1842.

This species belongs to a taxonomically most difficult complex including *L. rigidus, L. tremulus, L. tenuifolius* and their many close allies. The complex can easily be defined by the large compound fasciculate panicle with pendant staminate partial inflorescences, fuscous sheaths, and oval to obovoid fructifications that are more or less foveolate or rugose and conspicuously constricted at the base of a short conical beak. The distribution range of the complex covers the West Indies, the Guayana Highland and the southeastern part of Brazil from Bahia southwestewards to Sáo Paulo. *L. guianensis* resembles this complex in general features but is distinct from it by the erect, rigid staminate branches and quite smooth fructifications without any conspicuous constrictions between the body and the long beak.

Due to the great variability in both vegetative and floral parts, a number of names have been published at both specific and infra-specific levels within the *L. rigidus* complex, but actual differences among these taxa have never been investigated satisfactorily. C. B. Clarke[17] based his new taxa largely on dimensions of various parts of plants. Similarly H. Pfeiffer,[18] who studied the entire genus monographically, differentiated taxa by the density, size and the manner of branching of inflorescence and in some instances by the size of fructifications. In order to testify to the reality of these taxa, which are after all based on qualitative characters, variations have been investigated on 171 specimens selected at random from major United States herbaria including F, NY and US. As a result, in this complex the size and features of fructifications were found to have very little taxonomic significance for separation of taxa, as fructifications vary from 2.5 to 4.5 mm in length, elliptic to obovate or broadly obovate in shape, and from conspicuously foveolate or rugose to almost smooth in texture (Fig. 8, A–F). There is no discontinuity in any of these characters. The structure and form of inflorescence provides no criteria for taxonomic distinction. The inflorescences show continuous variation from a narrow, loose panicle to a large compound panicle consisting of several partial fascicles; the form often correlated with vigor and size of plants.

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[17] C. B. Clarke, Kew Bull. Add. Ser. No. 8. 1908.

[18] H. Pfeiffer, Additamenta ad cognitionem generis Lagenocarpus. I. Ber. Deutsch. Bot. Ges. **39**: 125–134. 1921; III. In Fedde, Repert. Sp. Nov. **18**: 72–93. 1922; IV. In Fedde, Repert. Sp. Nov. **20**: 42–45. 1924.

TABLE 2

Measurements of Leaf Width in 171 Specimens of the *Lagenocarpus rigidus* Complex.

Width in mm	Number of plants
0.0– 2.5	14
2.6– 5.0	2
5.1– 7.5	38
7.6–10.0	48
10.1–12.5	40
12.6–15.0	18
15.1–17.5	5
17.6 +	6
Total	171

Variations in leaf characters have also been checked in the 171 specimens mentioned above. As seen in Table 2, measurements of leaf width show a bimodal concentration, and there *L. tenuifolius,* circumscribed by the narrow leaves less than 5 mm wide, can be separated from the rest of the plants of this complex having broader leaves more than 5 mm wide. No morphological character was found to divide the narrow-leaved *L. tenuifolius* any further.

The plants of the *L. rigidus-tremulus* alliance have broad leaves more than 5 mm in width. *L. tremulus* originally described from British Guiana differs slightly from *L. rigidus* of southeastern Brazil by leaf differences. In *L. tremulus* leaf blades are generally septate-nodose at least toward the base and are never curled though sometimes in dry localities, weakly recurved, whereas in *L. rigidus* they are not septate-nodose and radical blades are strongly to moderately curled. So far as we have examined specimens, all plants from the West Indies fall under the category of *L. tremulus,* while all specimens from southeastern Brazil show the feature of *L. rigidus.* The plants from the Guayana Highland, however, are a mixture of *L. tremulus, L. rigidus* and intermediate forms between these two plants. Furthermore the intermediates show two different character combinations of leaves, i.e., septate and curled leaves, and non-septate and non-curled blades.

For a better understanding of the relationship between *L. tremulus* and *L. rigidus,* 110 specimens selected at random from the Guayana collections of The New York Botanical Garden have been divided into four groups in accordance with four different character combinations of leaves, and the number of specimens of each group has been tabulated in Table 3. In this table remarkable correlations have been detected in the two character combinations representing the phenotypes of typical *L. tremulus* and *L. rigidus* respectively. Although we do not intend to go any further on this problem without experimental work, the segregation ratio of the four phenotypes of Table 3 suggests a linkage in leaf character and possible hybridization between *L. tremulus* and *L. rigidus* in Guayana. From this consideration and the geographical distribution of the two assumed parents, *L. rigidus* and *L. tremulus, L. tremulus* is recognizable in Guayana though not clear-cut. All the other broad leaved specimens, representing binomials that were proposed chiefly by H. Pfeiffer (1922) and Gilly,[19] are included within the variation range of the complex discussed above.

Very variable *L. rigidus* is thus regarded as consisting of three subspecies: *rigidus, tenuifolius* and *tremulus.*

Table 3

Distribution of the Number of Specimens of the Four Different Phenotypes in the *L. rigidus-tremulus* Alliance from Guayana. For detailed interpretation see the text.

Leaves	curled	non-curled
non-septate	47 (= *L. rigidus*)	8
septate	11	44 (= *L. tremulus*)

1a. **Lagenocarpus rigidus** subsp. **rigidus.** Fig. 8, A, B.

Scleria rigida Kunth, Enum. Pl. **2**: 355. 1837.
Lagenocarpus topazinus Nees, Fl. Bras. 2(1): 168. 1842. Syn. nov.
Lagenocarpus martii Nees, Fl. Bras. 2(1): 169. *t. 21.* 1842. Syn. nov.
Microlepis elatior Schrader ex Nees, Fl. Bras. 2(1): 167. 1842. Nomen invalidum ex synonymis.
Microlepis rigidifolia Schrader ex Nees, Fl. Bras. 2(1): 168. 1842. Nomen invalidum ex synonymis.
Microlepis bahiensis Schrader ex Nees, Fl. Bras. 2(1): 169. 1842. Nomen invalidum ex synonymis.
Lerisca rigida (Kunth) Schlechtendal, Bot. Zeit. **3**: 476. 1845.
Scleria topazina (Nees) Steudel, Syn. Pl. Glumac. 2, 177. 1855.
Scleria viridifolia Steud., Syn. Pl. Glumac. 2, 177. 1855. New name for *Lagenocarpus martii.*
Lagenocarpus neesii Böcklr., Linnaea **38**: 426. 1874. Syn. nov.
Cryptangium arundinaceum Böcklr., Flora **65**: 351. 1882. Syn. nov.
Lagenocarpus crassipes Böcklr., Flora **63**: 453. 1880. (fide Ind. Kew.)
Cryptangium dioicum Böcklr., Allg. Bot. Zeitschr. **2**: 142. 1896. Syn. nov.
Lagenocarpus pauloensis Palla, Denkschr. Akad. Wiss. Wien Math.-Nat. Kl. **79**: 198. 1906 Syn. nov.
Lagenocarpus oocarpus C. B. Clarke, Kew Bull. Add. Ser. 8, 63. 1908. Syn. nov.
Lagenocarpus mendoncae C. B. Clarke, Kew Bull. Add. Ser. 8, 63. 1908. Syn. nov.
Lagenocarpus dioicus (Böcklr.) H. Pfeiff., Ber. Deutsch. Bot. Ges. **39**: 131. 1921.
Lagenocarpus tremulus Nees var. *brevifolius* H. Pfeiff. in Fedde, Repert. Sp. Nov. **18**: 75. 1922. Ex parte, excl. basionym.
Lagenocarpus warmingii H. Pfeiff. in Fedde, Repert. Sp. Nov. **18**: 76. 1922. Syn. nov.
Lagenocarpus scalariformis H. Pfeiff. in Fedde, Repert. Sp. Nov. **18**: 77. 1922. Syn. nov.
Lagenocarpus martii Nees f. *dioicus* (Böcklr.), f. *longirostris*, f. *longinux* et f. *intermixtus* H. Pfeiff. in Fedde, Repert. Sp. Nov. **18**: 79. 1922.
Lagenocarpus rigidus Nees f. *gracilior*, f. *robustior* et f. *elatior* H. Pfeiff. in Fedde, Repert. Sp. Nov. **18**: 80. 1922.
Lagenocarpus rigidus Nees var. *arundinaceus* (Böcklr.) H. Pfeiff. in Fedde, Repert. Sp. Nov. **18**: 80. 1922.
Lagenocarpus rigidus Nees var. *arundinaceus* H. Pfeiffer f. *neesii* H. Pfeiff. in Fedde, Repert. Sp. Nov. **18**: 80. 1922.
Lagenocarpus dusenii H. Pfeiff. in Fedde, Repert. Sp. Nov. **18**: 80. 1922. Syn. nov.
Lagenocarpus giganteus H. Pfeiff. in Fedde, Repert. Sp. Nov. **18**: 81. 1922. Syn. nov.
Lagenocarpus giganteus H. Pfeiff. f. *polystachyus* H. Pfeiff. in Fedde, Repert. Sp. Nov. **18**: 82. 1922.

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[19] Gilly, C. L. Cyperaceae tribe *Cryptangieae.* Fieldiana Bot. **28**(1): 53–60. 1951.

Type. Brasilia meridionalis. *Sellow.*

Distribution. Southeastern Brazil and the Guayana Highland, common. VENEZUELA. Bolívar: La Gran Sabana, between Kun and Uadurara-Parú in valley of Río Kukenan, south of Mt. Roraima, alt. 1065–1220 m, *Steyermark 59047* (F); Mt. Roraima, stony slopes with sandy soil, Philipp Camp, alt. 5200–6000 ft, *Tate 295;* Mt. Roraima, Paulo, alt. 4000 ft, *Tate 147;* Ptari-tepuí, northwestern slopes, savanna at alt. 1500 m, *Maguire, Wurdack & Maguire 33849;* Kavanayen, alt. 1300 m, *Maguire, Wurdack & Maguire 33666;* Kavanayen Mission, woodland slopes, savanna, alt. 1300 m, *Maguire, Wurdack & Maguire 33711;* Quebrada at Kavanayen, alt. 4000 ft, *Maguire, Wurdack & Maguire 33985;* Uaipan-tepuí, savannas west side of Uaipan, alt. 1400 m, *Phelps & Hitchcock 326;* Selvas de galeria del Río Uairen, Sta. Elena, *Tamayo 2839* (NY, US). Amazonas: Cerro Guanay, summit, alt. 1800 m, dry rocky slopes, *Maguire, Cowan & Wurdack 31688;* Northwestern ridge, above Camp Yutaje, alt. 1500 m, *Maguire & Maguire 35377*. BRAZIL. Without definite locality, *Glaziou 15603* (C, syntype of *L. warmingii;* F, photo), *Glaziou 13308* (C, type of *Cryptangium arundinaceum;* F, photo), *Glaziou 17875* (C, type of *L. giganteus* f. *polystachus;* F, photo); Goias: *Glaziou 22360* (NY, isosyntype of *L. rigidus* f. *elatior*); Parana: Jaguariahyva in campo arenoso ad rivulum, *P. Dusén 13251* (NY, isotype of *L. dusenii*); Minas Gerais: without definite locality, *Glaziou 20552* (NY, isotype of

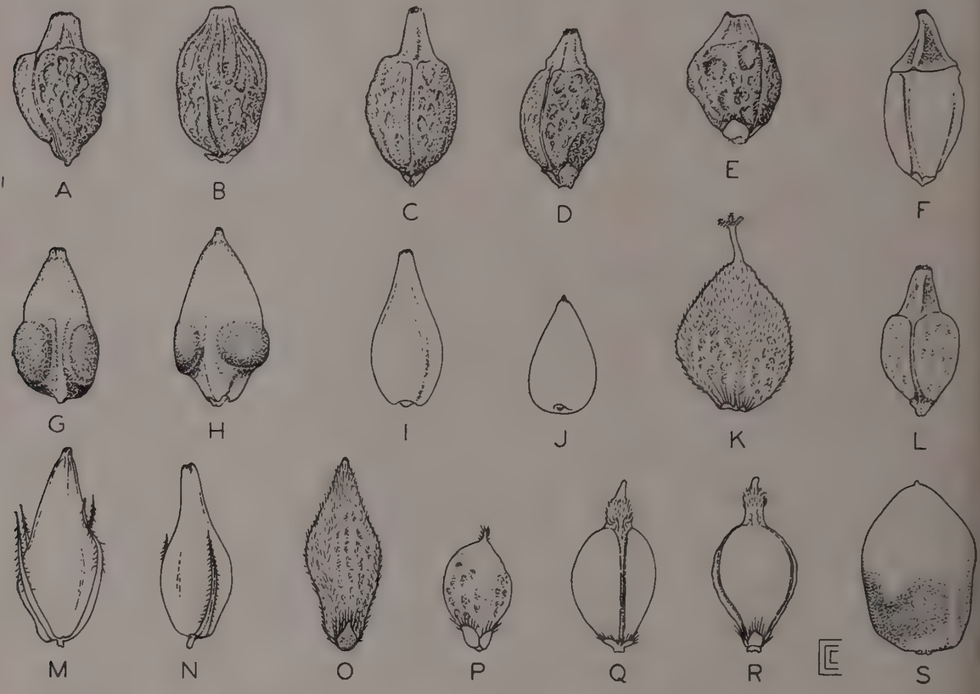

FIG. 8. Fructifications of *Lagenocarpus*. A, B *Lagenocarpus rigidus* subsp. *rigidus* × 7, B from one of syntype specimens of *L. oocarpus;* C, D, F, L *Lagenocarpus rigidus* subsp. *tremulus* × 7; E *Lagenocarpus rigidus* subsp. *tenuifolius* × 7; G, H *Lagenocarpus sabanensis* × 7; I, J *Lagenocarpus guianensis* subsp. *guianensis* × 7; K *Lagenocarpus albo-niger* × 6; M, N *Lagenocarpus guianensis* subsp. *hypochaetus* × 7, M from type; O, P *Lagenocarpus glomerulatus* × 8, O from monoecious specimen; Q, R *Lagenocarpus pendulus,* both from type × 8; S *Lagenocarpus celiae,* from type × 8.

L. martii f. *intermixta*), Voyage d'Auguste de St.-Hilaire. Cat. B 1, no. 426 (NY, P); Serra do Cipó, 3–5 miles from Hotel Chapeu de Sol, alt. 3700 ft, *Maguire, Maguire & Pires 44688;* Mun. Jaboticatubas, Serra do Cipó, Chapeu de Sol, *L. B. Smith 7052* (NY, US); margine fossarum ad Fanado, *Martius 37* (M, type of *L. topazinus;* F, US, photo); S. João d'El Rei, *Glaziou 16933* (F); Diamantino, Barão, alt. 1170 m, 1 km along railroad on embankment among other grasses, *Mexia 5892* (F, NY); Serra de S. Jose d'El Rei, *Glaziou 17873* (NY, isosyntype of *L. oocarpus*)*;* Buenopolis, Serra do Cabral, *Magalhães 4446;* Bello Horizonte, Serra do Curral, *Magalhães 4500;* Rio de Janeiro: Distr. Federal, Recreiro dos Bandeirantes, *Lutz 614* (US); Distr. Federal, Praia de Sernambetiba, *L. B. Smith 6379* (US)[20]; Rio de Janeiro, environs, *Glaziou in 1874* (s.n.), *Glaziou 16553* (C, K, syntypes of *L. oocarpus;* F, photo); Haut de Orgaos, *Glaziou 16924* (F); São Paulo: Campo da Bocaina, *Glaziou 11649* (NY, P).

1b. **Lagenocarpus rigidus** subsp. **tenuifolius** (Böcklr.) T. Koyama & Maguire, stat. nov. Fig. 8, E.

Cryptangium tenuifolium Böcklr., Cyp. Nov. (Beitr. Kennt. Cyp.) Heft 1, 32. 1888.
Cryptangium brevifolium Böcklr., Allg. Bot. Zeitschr. 2: 143. 1896. Syn. nov.
Lagenocarpus tenuifolius (Böcklr.) C. B. Clarke, Kew Bull. Add. Ser. 8, 64. 1908.
Lagenocarpus tenuifolius C. B. Clarke var. *Riedelii* C. B. Clarke, Kew Bull. Add. Ser. 8, 64. 1908. Syn. nov.
Lagenocarpus brevirostris C. B. Clarke, Kew Bull. Add. Ser. 8, 65. 1908. Syn. nov.
Lagenocarpus inversus C. B. Clarke, Kew Bull. Add. Ser. 8, 64. 1908. Syn. nov.
Lagenocarpus tremulus Nees var. *brevifolius* (Böcklr.) H. Pfeiffer in Fedde, Repert. Sp. Nov. 18: 75. 1922. Ex parte, quoad basionym.
Lagenocarpus lapaensis H. Pfeiffer in Fedde, Repert. Sp. Nov. 18: 86. 1922. Syn. nov.

Type. Brazil [sine loco speciali], *A. Glaziou 5444* (B).

Distribution. Scattered on the highland in southeastern Brazil covering Goias, Minas Gerais and São Paulo. BRAZIL. Without definite locality, *Glaziou 17874* (C), *20099;* Goias, region of Chapada dos Veadeiros at 47° 30′ W, 14° 30′ S, wet spring area among some rocks on gentle slope, 10 km from Veadeiros on Cavalcante Rd., alt. 5600 ft, *Dawson 14773* (US); Serra da Lapa, in pratis arenosis, *Riedel 944* (B, type of *L. lapaensis;* F, photo; K, syntype of *L. tenuifolius* var. *Riedelii;* US, isotype); Serra da Lapa in glareosis, *Riedel 1126* (US); S. Bartholomeo, *Glaziou 15595* (B, type of *Cryptangium tenuifolium;* F, P, isotypes); Minas Gerais: without definite locality, *Glaziou 20056, 20057 & 20058* (K, syntypes of *L. brevirostris;* B, isosyntype; F, US, photo of isosyntype); Cipó, *Glaziou 20054* (K, syntype of *L. inversus;* F, isosyntype and photo); Serra do Cipó, 115 km, estrada para Conceiçao, *Magalhães 18951;* summit of Serra do Cipó, 112–128 km, on road from Hotel Chapeu do Sol, alt. 1200–1300 m, *Maguire, Magalhães & Maguire 49079;* Serro, Alto do Pico, Itambe, campo humido, *Magalhães 1707*.

1c. **Lagenocarpus rigidus** subsp. **tremulus** (Nees) T. Koyama & Maguire, stat. nov. Fig. 8, C, D, F, L.

Lagenocarpus tremulus Nees, Fl. Bras. 2(1): 167. 1842.
Anogyna tremula (Nees) Nees in Hooker, Jour. Bot. 2: 395. 1840.
Cryptangium kuntzeanum Böcklr., Cyp. Nov. (Beitr. Kennt. Cyp.) Heft 1, 32. 1888. Syn. nov.
Cryptangium tremulum (Nees) Böcklr., Allg. Bot. Zeitschr. 2: 143. 1896.

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[20] Transitional form to subsp. *tremulus,* but leaves are not very clearly septate.

Lagenocarpus kuntzeanus (Böcklr.) O. Kuntze, Rev. Gen. Pl. 2: 754. 1891.

Lagenocarpus tremulus Nees forma *multigyna* [sic] H. Pfeiffer in Fedde, Repert. Sp. Nov. 18: 75. 1922. New name for *Cryptangium kuntzeanum.*

Lagenocarpus tremulus Nees var. *brevifolius* H. Pfeiffer in Fedde, Repert. Sp. Nov. 18: 75. 1922. Ex parte incl. basionym.

Lagenocarpus bifidus Gilly, Fieldiana Bot. 28(1): 56. 1951. Syn. nov.

Lagenocarpus diffusus Gilly, Fieldiana Bot. 28(1): 56. 1951. Syn. nov.

Lagenocarpus steyermarkii Gilly, Fieldiana Bot. 28(1): 58. 1951. Syn. nov.

Type. Guiana anglica interior. *Schomburgk.* (fragment in NY).

Distribution. Widely distributed in the West Indies, the Guayana Highland and the northern part of Brazil adjacent to Guayana. The specimens of the following numbers have been examined. WEST INDIES. Cuba, Isle of Pines: *Britton, Britton & Wilson 14349; Jennings 327; Ekman 12142.* Trinidad: Aripo Savanna, *Beard 127* (A, NY); *O. Kuntze 1042; Britton, Broadway & Hazen 273;* Arima, *O. Kuntze 1015.* SURINAME. Tafelberg, *Maguire 24221;* Zanderij II., *Maguire & Stahel 23660, 23721; Lanjouw & Lindeman 113* (L, NY). BRITISH GUIANA. *Schomburgk s.n.;* Rupununi, *Harrison 1359;* Orinduik Falls, *Harrison 1443;* Kaieteur Plateau, *Maguire & Fanshawe 23465;* Imbaimadai, *Maguire & Fanshawe 32164;* Karowtipu, *Tillett & Tillett 45601;* Pakaraima Mts., *Maguire, Maguire & Wilson-Browne 46206A;* Holitipu, *Maguire & Fanshawe 32502, 32549.* VENEZUELA. Bolívar: Roraima, *Tate 24; Steyermark 58663, 59302* (F, type of *L. bifidus,* from south of Mt. Roraima, between Divine Pastora on Río Kukenan and S. Elena, alt. 915–1005 m); Ilu-tepuí, *Maguire 31384;* Kavanayen, *Steyermark 59363* (F, type of *L. steyermarkii,* from Mission of Santa Teresita de Kavanayen, NW of Río Karuai, on large mesa, alt. 1220 m), *60341;* Ptari-tepuí, *Steyermark 59638, 59665;* Sabana de Triana, *Steyermark 89695;* Chimantá-tepuí, *Steyermark & Wurdack 328, 988;* Uriman, *Bernardi 874, Steyermark 75273;* Uaipan-tepuí, *Phelps & Hitchcock 410, Steyermark & Nilsson 552, Cardona 2025* (US, VEN); Cerro Piton, *Maguire, Steyermark & Maguire 53658.* Amazonas: Serrania Yutaje, *Maguire & Maguire 35504, 35407;* Cerro Yaví, *Phelps & Hitchcock 14;* Río Atabapo, *Williams 13851;* Cerro Parú, *Cowan & Wurdack 31384;* Cerro Moriche, *Maguire, Cowan & Wurdack 30853;* Cerro Duida, *Steyermark 57856, Tate 1040;* Cerro Sipapo, *Maguire & Politi 27690, 27607, 28193.* BRAZIL. Amapá, km 48, road to Amapá, frequent in marshy savanna, *Pires & Cavalcante 52053.*

2. **Lagenocarpus sabanensis** Gilly, Fieldiana Bot. **28**(1): 57. 1951. Fig. 8, G, H.

[Descr. emend. & amplif.] Rhizome short, ascending, thickly clothed with brown fibrous remains of basal sheaths; underground stolons elongated to 15 cm, 5 mm thick, surrounded by brown lanceolate scales about 2 cm long. Culm solitary, central, 80–150 cm tall, trigonous, 3–5 mm thick below, puberulent, 4–6-nodose. Leaves radical and 2 to 4 upper on the culm; the blades narrowly linear, straightish, stiff, folded, 60–90 cm long, 5–7 mm wide, puberulent, very glaucous beneath, gradually attenuate toward very sharp apex; sheaths 3–4 cm long, brown or purplish-brown; contra-ligules broadly deltoid, 2.5–4 mm long, acutish or obtusish. Inflorescence a slender terminal compound panicle, more or less interrupted or contiguous, 50–70 cm long; the lower 2 to 4 partial panicles staminate with pendant slender fascicled branches, long-exserted and rather spreading; the upper 2 or 3 partial panicles pistillate with erect, relatively short branches. Staminate spikelets oblong, 3.5 mm long; glumes several, oblong-elliptic, 2.5 mm long, with a short awn at apex; stamens 2 or 3. Pistillate spikelets ellipsoid at maturity; glumes 4 to 6, imbricate, broadly ovate to suborbicular-obovate, 2.5–3 mm long, about 2 mm wide, thickly chartaceous to thinly coriaceous, tawny or cinnamon-colored, rounded to shallowly emarginate at apex, ciliate on margins, the awn short, upright. Fructifications ovoid (rarely broadly ovoid), 4–4.5 mm long, 2–2.2(–2.6) mm wide, terete, inconspicuously trigonous, brownish-yellow, the lower part with 3 large dark brown moles, the upper part (= beak) thickly conical, abruptly pointed at apex, wholly glabrous; stigmas 3.

Type. Sabana Grande, southeastern base of Cerro Duida, alt. 200 m, Amazonas Venezuela, ***Julian A. Steyermark 57855*** (F, holotype).

Distribution. Western part of Venezuela, Mt. Duida and westward, and eastern Vaupés, Colombia. VENEZUELA. Amazonas: Esmeralda, alt. 325 ft, east swamp, *Tate 238;* E-W. Cano, north of Cerro Yapacana, mine trail, savanna No. 1, alt. 125 m, *Maguire, Cowan & Wurdack 30777;* Sabanita, northwestern base of Cerro Moriche, alt. 150 m, *Maguire, Cowan & Wurdack 31000;* Alto Río Orinoco, 2 miles below Santa Barbara, woodland between Savanna 2 and 3, *Maguire, C. K. Maguire & Wurdack 34545;* Cano Guasuriapana, San Fernando de Atabapo, alt. 100 m, *Maguire, Wurdack & Bunting 36243.* COLOMBIA. Vaupés: Río Inirida, ***Fernandez 2193*** (US).

This good species had already been collected by Tate from the Mt. Duida region some 30 years before it was described by Gilly based on a Steyermark collection. *L. sabanensis* is, as indicated by Gilly, more or less related to *L. guianensis* particularly in the character of fructifications. But, the fructifications are definitely larger than those of *L. guianensis* and have three large moles below the middle, suggesting also the taxonomic affinity with *L. rigidus.* Since Gilly's original description was based on a specimen without any mature fructification the description, drawn from the additional collection, is here amended and amplified.

3. Lagenocarpus guianensis Lindley & Nees ex Nees (Linnaea **9**: 304. 1834. nom.) Fl. Bras. **2**(1): 166. 1842.

3a. Lagenocarpus guianensis subsp. **guianensis.** Fig. 8, I, K.

Phaenopyrum paniculatum Schrader ex Nees, Fl. Bras. 2(1): 166. 1842. Nomen invalidum ex synonymis.
Scleria guianensis (Lindl. & Nees) Steudel, Syn. Pl. Glumac. 2, 177. 1855.
Lagenocarpus riedelianus C. B. Clarke, Kew Bull. Add. Ser. 8, 63. 1908. Syn. nov.
Lagenocarpus sprucei H. Pfeiffer in Fedde, Repert. Sp. Nov. 18: 74. 1922. Syn. nov.
Lagenocarpus guianensis Lindl. & Nees var. *typicus* H. Pfeiffer in Fedde, Repert. Sp. Nov. 18: 75. 1922.
Lagenocarpus guianensis Lindl. & Nees var. *paraensis* H. Pfeiffer in Fedde, Repert. Sp. Nov. 18: 75. 1922. Syn. nov.
Lagenocarpus guianensis Lindl. & Nees forma *gracilior* H. Pfeiffer in Fedde, Repert. Sp. Nov. 20: 42. 1924. Syn. nov.
Lagenocarpus portoricensis Britton, Bull. Torrey Club 50: 55. 1923.

Fructifications ovoid, 3–4 mm long, less than 2 mm wide, contracted to the apex without conspicuous beak or the beak very short. Hypogynous squamellae minute, rounded-deltoid, about 0.1 mm long. Inflorescence dense with rigid diverged branches.

Type. Guiana anglica interior, *Schomburgk.*

Distribution. Widely but more or less discontinuously distributed in the West Indies, Honduras, Guayana, and southeastern Brazil. HONDURAS. Toledo District, Monkey River near Jenkins Creek, in pine ridge, *Gentle 4160* (F, MICH, NY, US); All Pines, near brackish swamp, *Schipp 589.* WEST INDIES. Trinidad: without definite locality, O. Kuntze *s.n.*, in 1874; in Aripo Savanna, *Broadway 5331* (F), open savanna alt. 100 ft, *Richardson 920* (US); Cumuto, *Broadway 7592;* Aripo, *Britton 5331;* Santa Cruz, *Dannouse 8249.* Puerto Rico: Manati to Vaga Baja, in sand, *Griggs 946* (NY, holotype of *L. portoricenses*). BRITISH GUIANA. East Coast Water Conservancy, southeast of Georgetown, Hoorbia Creek, *A. S. Hitchcock 16907* (NY, US); Ebini Exp. Sta., Keskiv River, marsh, *Harrison 748* (K, NY); NW District: Amakura River, *De La Cruz 3545;* Waini River, *De La Cruz 3726* (F, NY). VENEZUELA. Bolívar: Alto Río Cuyuni, Cordillera Epicara, on southeastern escarpment of Cerro Piton, alt. 400 m, infrequent along stream, *Maguire, Maguire & Steyermark 53649.* Amazonas: Maroa, Río Guainía, alt. 127 m, *Williams 14327* (F). BRAZIL. Pará: in vicinibus Santarem, *R. Spruce [13]* (M, type of *L. sprucei;* NY, isotype and photo); Prov. Rio Negro, in vicinibus Barra, *R. Spruce [925]* (M, type of *L. guianensis* forma *gracilior;* NY, isotype). Bahía, in pratis hieme inundatis prope Ilheor, *Riedel 147* (K, type of *L. riedelianus;* C, LE, US, isotypes; F, photo).

3b. Lagenocarpus guianensis subsp. **hypochaetus** T. Koyama, subsp. nov. Fig. 8, M, N.

Fructificationes grandiores (4.3–)5–6.2 mm longae 2–2.2 mm latae lanceolato-oblongae vel anguste ovatae apice in rostrum sublongum conspicuum subsensim attenuantes. Squamellae hypogynae subulato-setiformes cum 1/2–3/5-fructificationi aequilongae antrorsim spinuloso-ciliatae. Inflorescentia angustior et laxior, ramis erecto-patentibus magis flaccidioribus. Caeteroquin sicut ssp. *guianensis.*

Type. Alto Río Orinoco, Río Guainía, between Comunidad and Guzman Blanco, alt. 120–130 m, on island just below Guzman Blanco, *Bassett Maguire, J. J. Wurdack & Celia K. Maguire 35554* (NY, holotype). Paratypes. BRAZIL. Amazonas: Rio Negro, at mouth of Rio Uaupés, *Baldwin, Jr. 3480* (US); Rio Cucuriari (middle course), in water, *Schultes & Lopes 9707* (US).

Distribution. Western Guayana and its adjacent regions; known only by the cited specimens.

This subspecies differs from subsp. *guianensis* by the larger fructifications subtended by hypogynous bristles, which attain the length of the body of the fructification. Superficially it can be recognized by the looser and narrower inflorescence, of which the branches are more flexible and not so divergent as in subsp. *guianensis.* The collected specimens suggest that this new subspecies has its own range lying in the small western portion of Guayana. Subspecific status is designated on the basis of both morphological and geographical evidences.

4. Lagenocarpus pendulus T. Koyama, sp. nov. Fig. 8, Q, R.

E vicinia *L. sabanensis* a qua tamen fructificationibus obovoideo-ellipsoideis, rostro parvi pubescenti, squamellis hypogynis longe-ciliatis, spiculis pendulis, squamis hyalinis valde distat. Sect. *Lagenocarpus.*

Rhizoma crassiusculum decumbenti-ascendens usque ad 8 cm longum 17 mm crassum fibris fusco-brunneis vestitum. Folia in majore parte radicalia et 2 vel 3 superiora caulina; laminae anguste lineares 40–65 cm longae 3–5 mm latae plicato-planae rigidulae supra minutissime verruculosae ad apicem acutissimam sensim attenuantes subtus pallidiores et plerumque puberulentes; vaginae 2–3 cm longae sparse puberulentes mox glabrae apicem versus brunneotinctae, contraligula rotundo-deltoidea 2–3 mm longa, ciliata. Culmus solitarius centralis 80–100 cm altus gracilescens obtuse trigonus facie canaliculatus apice puberulens basi mox glaber. Inflorescentia 30–60 cm longa apice cernua fasciculato-paniculata subcontigua vel plus minus interrupta, axe ramisque pubesulentibus, bracteis panicula sua multo brevioribus; paniculae partiales inferiores 2 masculae, ceterae foemineae, ramis ramulisque gracilibus pendulis, bracteolis vaginiformis. Spiculae masculae solitariae vel geminae 3 mm longae anguste ellipticae; glumae plures ellipticae acutae adpresse hispido-pubescentes; stamina plerumque 2. Spiculae foemineae solitariae uniflorae maturitate ellipsoideae 3.5 mm longae fulvo-brunneae; glumae imbricatae circiter 6, superiores late ellipticae 3 mm longae vix 2 mm latae hyalinae vel membranaceae polisulae margine sericeo-ciliatae apice acutae vel leviter bilobae breviaristatae. Fructificationes glumas fere aequantes obovoideo-ellipsoideae cum rostro 2.5–3 mm longae 1.25–1.5 mm latae teretes trisulcatae fulvae apice abrupte contractae, rostro brevi conico 2/3 mm longo 1/3 mm lato pubescente, stigmatibus 3. Squamellae hypogynae 3 orbiculato-ovatae margine pilis albis dense ciliatae.

Type. Río Kananari and Cerro Isibukuri, alt. 250 m, Vaupés, Colombia, *H. Garcia-Barriga 13797* (US, holotype; COL, isotype).

Paratype. Río Kubiyu, Cerro Kanenda, savannahs about 15 miles upstream from mouth, quartzite base, alt. 800–900 ft, Vaupés, COLOMBIA, *Schultes & Cabrera 18363* (US).

Distribution. Known only by the cited specimens.

This new species superficially resembles *L. sabanensis*, but differs from it by its peculiar features of spikelets: fructifications with short pubescent beak, conspicuously ciliate hypogynous squamellae, and thinly membranous pistillate glumes. Especially the first character shows an affinity of this taxon with the section *Corymbosi*, though it is placed in the section *Lagenocarpus* because of the shape of its inflorescence.

Lagenocarpus sect. **Imberbitae** H. Pfeiffer in Fedde, Repert. Sp. Nov. **18**: 83. 1922.

Type. *Lagenocarpus albo-niger* (St. Hil.) C. B. Clarke (lectotype).

A distinct section of the genus, characterized by medium-sized inflorescences and culms, often lanate basal sheaths, and beakless fructifications. Spikelets are disposed in almost simple umbels or clustered in glomerules. This section has hitherto been known from southeastern Brazil, and here three species are added from Guayana.

Key to Species of the Section *Imberbitae*

1. Plants not wooly at base, i.e., basal leaf sheaths glabrous or only puberulent, not at all or becoming loosely fibrous.
  2. Stoloniferous; both staminate and pistillate spikelets solitary on the peduncles, which are disposed in umbels. 5. *L. celiae.*
  2. Not stoloniferous, tufted; staminate and sometimes pistillate spikelets (1–2 or more) congested in glomerules, which are disposed in partially paniculate corymbs.
    3. Leaves glabrous, linear-lanceolate, about 1/3 as long as the culm; fructifications large, 4.5 mm long or more. 6. *L. adamantinus.*
    3. Leaves short-villous, linear, 1/2 as long as the culm or longer; fructifications medium-sized, less than 3.5 mm long.
      4. Glomerules of spikelets on long-exserted peduncles; radical leaf-blades curled. 7. *L. griseus.*
      4. Glomerules of spikelets congested in an axillary head-like cluster; radical leaf-blades not curled. 8. *L. velutinus.*

1. Plants wooly at base, i.e., basal sheaths disintegrated into fibers densely covered with a cottony pubescence.
5. Leaf blades involute, 1.5–2 mm wide, pale-green; inflorescence small to medium-sized with rather many spikelets.
6. Glumes purplish-black; staminate spikelets clustered in glomerules; leaf blades pubescent. 9. *L. albo-niger.*
6. Glumes fuscous; staminate spikelets solitary and umbellate; leaf blades glabrous. 10. *L. eriopodus.*
5. Leaf blades flat or flattish, 6–8 mm wide, not pale; inflorescence ample with numerous spikelets. 11. *L. glomerulatus.*

5. **Lagenocarpus celiae** T. Koyama & Maguire, sp. nov. Fig. 8, S.

Species distinctissima et facile cognoscenda ob inflorescentiam simpliciter umbelliformem et fructificationes magnas obovoideo-ellipsoideas sine rostro conspicuo.

Planta monoica et etiam forsan dioica. Rhizoma breve erecto-ascendens fibris ferrugineo-brunneis parallelis crasse vestitum, stolonibus elongatis circiter 5 mm crassis usque ad 15 cm longis squamis ca. 15 mm longis mox fibroso-solutis obtectis. Folia in majore parte radicalia 1 vel 2 superiora caulina; laminae anguste lineares 25–45 cm longae culmum excedentes 3–4 mm latae rigidae plicatae demum involutae versus apicem acutam sensim angustatae; vaginae 5–15 mm longae fusco-tinctae, contra-ligulis rotundo-deltoideis 2 mm longis fusco-rubentibus glabris. Culmus solitarius centralis 18–32 cm altus infra medium 1.7–2 mm crassus obtuse trigonus vel fere teres laevissimus. Inflorescentia erecta 4–8 cm longa umbellis partialibus 3–6 constructa interrupta et apice tantum contigua, internodio axis 0.7–3 cm longo; bracteae foliaceae inflorescentiam longe excedentes basi breviter vaginantes; umbellae inferiores 2–4 masculae sed saepe spiculas foemineas 1 vel 2 ferentes, ceterae foemineae, vel interdum umbellae omnes foemineae; radii umbellarum 5–15 graciles recurvi 3–7 mm longi aut aequales aut inaequales. Spiculae masculae oblongae 2.5–3 mm longae 2/3 mm latae; glumae plures sublaxe imbricatae ovato-ellipticae fusco-rubentes apice acutae et breviaristatae; stamina plerumque 2. Spiculae foemineae solitariae raro geminae maturitate turbinatae 3–3.5 mm longae ac latae uniflorae; glume 3–5 imbricatae cum arista 3–3.5 mm longae late ovatae chartaceae multinervosae fusco-rubentes apice acutae obtusiusculaeve, arista ca. 1 mm longa. Fructificationes maturitate exsertae obovoideo-ellipsoideae vel late ellipsoideae 2.5–3.2 mm longae 2–2.2 mm latae fere teretes fulvae et infra medium fusco-tinctae apice basique subito contractae, stylo fere nullo, stigmatibus 3.

Type. Cacagual Savanna, Rio Atabapo, between San Fernando de Atabapo and Cano Temi, alt. 135 m, locally frequent, Vaupés, Colombia, *Bassett Maguire, John J. Wurdack, W. M. Keith & Celia K. Maguire 41454* (NY, holotype).

Paratypes. VENEZUELA. Amazonas: Sabana Pacimoni, on right bank of Rio Pacimoni, 50 km above mouth, alt. 100 m, *Maguire, Wurdack, Keith & Maguire 41679;* Alto Rio Orinoco, Yapacana Savannas, NW base of Cerro Yapacana, alt. 125 m, *Maguire, Wurdack, Keith & Maguire 41545A.*

Distribution. Known only by the cited specimens.

This striking species of the section *Imberbitae* can easily be recognized by the simple umbelliform partial inflorescences and the large obovoid-ellipsoid fructifications without any conspicuous beak. The specific epithet has been given in honor of Celia K. Maguire, who was co-collector of all of the specimens cited above.

6. **Lagenocarpus adamantinus** Nees, Fl. Bras. **2**(1): 165. *t. 20.* 1842.

Scleria adamantina (Nees) Steudel, Syn. Pl. Glumac. 2, 177. 1855.
Lagenocarpus bracteosus C. B. Clarke in Fedde, Repert. Sp. Nov. **2**: 145. 1906. Syn. nov.
Lagenocarpus adamantinus Nees var. *bracteosus* (C. B. Clarke) H. Pfeiffer in Fedde, Repert. Sp. Nov. **18**: 85. 1922.

Type. Prope Tejuco, Minas Gerais, Brazil, *Martius s.n.* (M).
Distribution. Southeastern Brazil; very local.

7. **Lagenocarpus griseus** (Böcklr.) H. Pfeiff., Ber. Deutsch. Bot. Ges. **39**: 131. 1921.

Cryptangium griseum Böckeler, Allg. Bot. Zeitschr. **2**: 143. 1896.
Lagenocarpus vestitus C. B. Clarke, Kew Bull. Add. Ser. 8, 64. 1908. Syn. nov.
Lagenocarpus sericeus H. Pfeiffer in Fedde, Repert. Sp. Nov. **18**: 83. 1922. Syn. nov.

Type. Minas Gerais, Brazil, *A. Glaziou 20059* (C, holotype; F, photo).

This species contains both monoecious and dioecious plants. The type of *Cryptangium griseum* is a pistillate plant, while the type of *Lagenocarpus sericeus* is a staminate one. C. B. Clarke, in his original description of *L. vestitus,* cited *Glaziou 20059,* which is the holotype of *Cryptangium griseum.* The other syntype cited by Clarke, *Riedel [476]* from Tymbo-peba, was determined from a photo as *L. griseus.* Therefore *L. vestitus* is synonymous with *L. griseus.*

8. **Lagenocarpus velutinus** Nees, Fl. Bras. **2**(1): 166. 1842.

Type. Itambe de Villa, 4–5000 ft, Minas Gerais, Brazil, *Martius 122.*
Distribution. Known only by the type collection.

Since we have seen a photo of the type only, we can offer no critical opinion of this plant. In general appearance, however, it closely resembles *L. griseus,* and further studies of sufficient material will possibly prove that the two are conspecific.

9. **Lagenocarpus albo-niger** (St. Hilaire) C. B. Clarke, Kew Bull. Add. Ser. 8, 64. 1908.

Scleria albo-nigra St. Hilaire, Voy. Brés., Distr. Diamans **1**: 371. 1833.
Cryptangium insigne Böckeler, Allg. Bot. Zeitschr. **2**: 143. 1896.
Lagenocarpus insignis (Böcklr.) H. Pfeiff., Ber. Duetsch. Bot. Ges. **39**: 132. 1921.
Lagenocarpus albo-niger Clarke var. *subglabra* H. Pfeiffer in Fedde, Repert. Sp. Nov. **18**: 85. 1922. Syn. nov.
?*Scleria tristis* St. Hilaire, Voy. Brés. Distr. Adamans **1**: 370. (ex H. Pfeiffer, 1922).

Type. Brazil (type reportedly in Paris).
Distribution. Southeastern Brazil, Minas Gerais; local.

10. **Lagenocarpus eriopodus** T. Koyama & Maguire, sp. nov. Fig. 8, O, P.

Ex affinitate *L. albo-nigris* quae diversa est glumis vaginisque fuscis non nigris, spiculis masculis oblongis paucius florentibus et foliis culmisque glabris. Sect. *Imberbitae.*

Monoicus. Rhizoma breve erecto-ascendens crassiusculum fibris fuscis et lanis albescentibus mortuorum vaginarum dense vestitum. Folia radicalia et summa tantum saepe caulina; laminae anguste lineares 25–45 cm longae 1.3–1.8 mm latae glabrae perrigidae plicato-involutae parte superiore plus minus triquetrae

apice acutae; vaginae fuscae vel fusco-rubentes parum dilatatae; contra-ligulis rotundo-deltoideis 0.5–1 mm longis fuscis ciliolatis. Inflorescentia 15–20 cm longa fasciculis 5(–6) valde remotis constructa; fasciculae partiales umbelliformes 9–15-spiculigerae, inferiores 3 masculae, superiores 2 vel 3 foemineae 2–4-spiculigerae; radii filiformes plerumque puberuli 0.7–2.5 cm longi spicula unica pendula terminati. Spiculae oblongae vel anguste ovatae 2–3 mm longae circiter 1 mm latae pauci- vel pluri-florae ferrugineo-fuscae; glumae anguste ovatae margine superiore ciliolatae apice acutae breviaristatae; stamina usque 6. Spiculae foemineae ovoideo-globosae 4–4.5 mm longae 2.7–3.5 mm in diametro ferrugineo-fuscae vel cinnamomeae; glumae 4–5 chartaceae imbricatae, inferiores transverse late ovatae, superiores late ovatae 3.5 mm longae 2.5–2.7 mm latae valde naviculares dorso multinerves adpresse pubescentes apicem versus breviter cuspidatam contractae. Fructificationes glumis subarcte inclusae late trullato-ovatae vere trigonae 3.8–4.2 mm longae 2.8–3 mm latae ad angulos et apicem dense tomentoso-pubescentes apice cuneato-contractae facie irregulariter aveolatae, stylo 0.8 mm longo, stigmatibus 3 brunneo-papulosis. Squamellae hypogynae depresse rotundo-deltoideae pilis sericeis 1/2 mm longis ciliatae.

Type. Alto Río Orinoco, Yapacana Savannas, northwestern base of Cerro Yapacana, 125 m alt., Amazonas, Venezuela, *Bassett Maguire, J. J. Wurdack, W. M. Keith, Jr. and Celia K. Maguire 41545* (NY, holotype).

Distribution. Known only by the type collection.

This pretty species is readily separable from *L. albo-niger* of southeastern Brazil by the glabrous culms and leaf blades, fewer-flowered staminate spikelets, and fuscous (not blackish) glumes, which are apparently smaller than those of the Brazilian species.

11. **Lagenocarpus glomerulatus** Gilly, Fieldiana Bot. **28**(1): 57. 1951.

Type. Savanna and shrubby growth bordering forest of Rio Karuai, between Santa Teresita de Kavanayen and base of Ptari-tepuí, alt. 1200 m, by fast water on rocks, Bolívar, Venezuela, *Julian A. Steyermark 60340* (F, holotype; ISC, isotype).

Distribution. Endemic in the eastern half of the Roraima Sediment region. VENEZUELA. Bolívar: Sierra Ichun, north of Salto Río Espuma, 4° 46′ N, 63° 18′ W, alt. 625–725 m, *Steyermark 90267* (NY, US). Amazonas: Rocky top of Esmeralda Ridge, alt. about 325 ft, *Tate 191;* Savanna about 1 km east of Maroa, abundant, *Maguire, Wurdack, Keith & Maguire 41761* [dioecious plant see note below]. BRITISH GUIANA. Savannas adjacent to Partang Rapids, 2–4 miles from Imbaimadai, in open savanna, *Maguire & Maguire 45916.*

This species is newly added to the flora of western Venezuela and the British Guiana Pakaraimas. The one collection, *Maguire et al. 41761,* is represented by pistillate plants only. In this collection the fructifications and glumes are some 1 to 1.5 mm longer than in the other specimens (Fig. 8: compare O with P). Whether or not this particular collection represents a subspecific taxon cannot at this time be determined.

Lagenocarpus sect. **Corymbosae** H. Pfeiffer in Fedde, Repert. Sp. Nov. **18**: 87. 1922. Ex parte et sensu emend.

Gen. *Cryptangium* Schrad. ex Nees, Fl. Bras. 2(1): 163. 1842.

Type. *Lagenocarpus verticillatus* (Spreng.) T. Koyama & Maguire (lectotype).

When Pfeiffer (1922) described the section *Corymbosae,* he included in his section both *L. strictus* (= *L. verticillatus, L. kunthii, L. uliginosus,* etc.) and the *L. minarum* complex without designating the type species. In our opinion, however, *L. strictus* and *L. minarum,* respectively, represent separate section by the leaf characters described in our key to sections. As Pfeiffer's original description applies partially to *L. strictus* and partially to *L. minarum,* it is not feasible to select the type species from the description of Pfeiffer. Here we typify the section *Corymbosae* with *L. strictus* and reinterpret the section as a population with bladed radical leaves. The section *Corymbosae* in this revised sense is formed from a single species widely distributed in Guayana and southeastern Brazil.

12. Lagenocarpus verticillatus (Sprengel) T. Koyama & Maguire, comb. nov.

Fuirena verticillata Sprengel, Novi Provent. Acad. Hal. & Berol. 47. 1819.
Fuirena weigelti Sprengel, Tent. Suppl. Syst. Veg. 4. 1826. (fide Uittien, 1943).
Scleria stricta Kunth, Enum. Pl. **2**: 355. 1837. Syn. nov.
Scleria leptocladia Poepp. & Kunth ex Kunth, Enum. Pl. **2**: 355. 1837. Syn. nov.
Scleria kunthii Miquel, Sert. Exot. 4, *t. 2.* 1842.
Cryptangium uliginosum Schrader ex Nees, Fl. Bras. 2(1): 164, *t. 19.* 1842. Nomen superfluum.
Lerisca stricta (Kunth) Schlechtdl., Bot. Zeit. **3**: 476. 1845.
Scleria hostmanniana Steudel, Syn. Pl. Glumac. 2, 178. 1855. Syn. nov.
Cladotheca vaginans Steudel, Syn. Pl. Glumac. 2, 178. 1855. Nomen invalidum ex synonymis.
Cryptangium leptoclad[i]um (Poepp. & Kunth) Böcklr., Linnaea **38**: 420. 1874.
Cryptangium leptocladum Kunth forma *longifolia* Böcklr., Linnaea **38**: 421. 1874.
Cryptangium ciliatum Böcklr., Cyp. Nov. 2, 29. 1890. Syn. nov.
Lagenocarpus strictus (Kunth) O. Kuntze, Rev. Gen. Pl. **2**: 754. 1891.
Lagenocarpus uliginosus (Schrad. ex Nees) O. Kuntze, Rev. Gen. Pl. **2**: 754. 1891. Combinatio illegitima.
Lagenocarpus ciliatus (Böcklr.) H. Pfeiff., Ber. Deutsch. Bot. Ges. **39**: 131. 1921.
Lagenocarpus strictus (Kunth) H. Pfeiffer in Fedde, Repert. Sp. Nov. **18**: 88. 1922.
Lagenocarpus strictus H. Pfeiff. var. *leptoclad[i]us* (Poepp. & Kunth) H. Pfeiffer in Fedde, Repert. Sp. Nov. **18**: 89. 1922.
Lagenocarpus kunthii (Miq.) Uittien, Fl. Suriname **1**(1): [in Meded. Kon Ver. Ind. Inst. 30:] 132. 1934.
Lagenocarpus weigelti (Spreng.) Uittien, Fl. Suriname **1**(1): 501. 1943.

Type. Brazil, without definite locality, *Otto* [in Herb. Sprengel].

Distribution. Guayana from Surinam and Amapá westwards to the Vaupés of Colombia, and southeastern part of Brazil. SURINAME. South Savanna, vicinity Arawak village of Mata, *Maguire & Stahel 24967* (F, NY); Zanderij II., near airport, *Lanjouw & Lindeman 274* (U, NY); Tibiti Savanna, savanna km 2, 9, 3rd line, *Lanjouw & Lindeman 1825* (U, NY). BRITISH GUIANA. Waranama Ranch, Berbice River, Muri scrub, white sand, *Harrison 1051* (K, NY); near Dadanawa, Upper Rupununi River, *De La Cruz 1771* (F, NY); Berbice Co., along Berbice-Rupununi Cattle Trail, Muri sand, *Abraham 260;* Upper Mazaruni River, *De La Cruz 2117* (F, NY); Rockstone, sandy scrub, *A. S. Hitchcock 17303* (NY, US); East of Rockstone, dry sandhills, *Gleason 779;* Mackenzie, Demerara River, Ituni River, collector ign. *F 2492.* VENEZUELA. Bolívar: Sabana de Triana, Río Chicanán, 50 km SE of El Dorado, alt. 300 m, *Steyermark 89702* (US). COLOMBIA. Vaupés: Caño Pacú, Savanna, *Schultes 5820A* (US). BRAZIL. Without definite locality, *Gardener 3547* (BM, NY); Brasilia meridionalis, *Sellow 1101* (B, type of *Cryptangium uliginosum,* F, US, photo); Prov. Rio Negro, in vicinibus Barra, *Spruce in 1850–51, s.n.;* Amapá: Rio Araguari, on sandy soil in exposed area, 2 km from river, along road from Porto Platon to Macapa, *Pires, Rodrigues & Irvine 51065.* Pará: Ins. Colares, ad ostia fl. Amazon, *Poeppig 366* (B, type of *Scleria leptocladia;* F, US, photo); Maicurú, S. Francisco, *Pires & Silva 4269.* Goias: Region of Chapada dos Veadeiros at 47° 30′ W, 14° 30′ S, sandstone outcrop, 7 km S of Veadeiros, *Dawson 14603* (US). Rio [de] Janeiro et Minas, *Glaziou 16532* (B, type of *Cryptangium ciliatum;* F, US, photos).

This species has generally passed under the name of *Lagenocarpus uliginosus* or *Lagenocarpus kunthii.* According to Uittien (1943), the correct name for it is *Lagenocarpus weigelti* (Sprengel, 1826, sub *Fuirena*) Uittien, because of priority. However, there is still an earlier name, *Fuirena verticillata* Sprengel (1819). It was validly published and represents this species, thus it takes priority over *Fuirena weigelti,* i.e., *Lagenocarpus weigelti.*

A few specialists including Kunth (1837) and H. Pfeiffer (1922) by published record indicate that *Fuirena verticillata* is not identical with *Lagenocarpus kunthii* but is the same as *L. rigidus.* There are apparently two different specimens bearing Sprengel's name, *Fuirena verticillata,* one in Halle and the other in Berlin. Arguments made by German cyperologists, who may have seen both specimens concerned, indicate the specimen in Halle to represent the present taxon, whereas the specimen in Berlin to be *L. rigidus.* Dr. Schultze-Motel (Berlin-Dahlem) and Dr. Werner (Halle) were kind enough to investigate the Sprengel herbaria and have found both specimens at present not extant. But, as early as 1842, the specimen at Halle, which is most likely to be the one cited by Sprengel in his Novi Proventes, had been chosen as the type specimen of *Fuirena verticillata* by Nees, who cited *Fuirena verticillata* as follows, under *Cryptangium uliginosum: Fuirena verticillata* Spr. Nov. Prov. 46. Schult. Mant. II. 136 et Herb. (exempl. originale.) In the same paper, Nees again cited Sprengel's binomial under *Lagenocarpus rigidus* as ''*Fuirena verticillata* Spr. Nov. Prov. 46. in Herb. Reg. Berol. nec nov. Prov.'' These statements are certainly pertinent to Article 8 of the International Rules of Botanical Nomenclature, and the specimen at Halle[21] should be designated as the type of *F. verticillata.* Böckeler (1874) also confirms the identity between *F. verticillata* and *Cryptangium uliginosum* (= *L. kunthii*) by citing the former as a synonym of the latter as ''—*Fuirena verticillata* C. Spreng. herb.''

Furthermore, Sprengel's original description in his Novi Proventus is applicable to *Lagenocarpus kunthii* (= *L. uliginosus*), *viz.* ''F. cymis pedunculatis verticillatis, . . . *Culmus* . . . superne e vaginis verticillatim pedunculos cymosos capillares promens. . . . *Pedunculi* unciales . . . *Squamae* exteriores ternae, . . . interiores hyalinae, setis numerosis caducis mixtae.''

For these reasons, *Fuirena verticillata* is here brought under *Lagenocarpus.* Finally, the name, *Cryptangium uliginosum,* is superfluous and illegitimate since an earlier valid name, *F. verticillata,* was cited under it as a synonym when published.

Lagenocarpus sect. **Acrocarpus** (Nees) T. Koyama, stat. nov.

Gen. *Acrocarpus* Nees, Fl. Bras. 2(1): 157. 1842.

Sect. *Paucistachyae* H. Pfeiffer in Fedde, Repert. Sp. Nov. **18**: 86. 1922. Ex parte, quoad *L. pauciflorum* tantum.

Subgen. *Cephalocarpus* H. Pfeiffer in Fedde, Repert. Sp. Nov. **18**: 91. 1922. Ex parte, basionymum excl.

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[21] According to Dr. Werner (Halle), the Sprengel herbaria at Halle are supposed to have been transferred to the Persoon Herbarium at Berlin, where most of them were destroyed by the last war. (Personal communication in 1964.)

Type. *Lagenocarpus polyphyllus* (Nees) O. Kuntze (lectotype; = *Acrocarpus polyphyllus* Nees).

This section is characterized by the aphyllopodic nature of culms. The lower part of culms with long internodes are clothed only with a few short bladeless cataphylls. The leaves of a normal kind are all aggregated above the middle part of culms, where internodes are very short. Small partial panicles are born at axils of upper leaves. In Cyperaceae similar habit can be seen in many species of *Scleria* and the section *Scleriiculmes* of *Carex*. Taxonomy of the species referable to this section has never been studied satisfactorily because of lack of material. The following plants seem to be pertinent to this section judging from descriptions. Further studies may prove that many of them are identical.

L. campestris (Nees) O. Kuntze
L. clarkei (H. Pfeiff.) H. Pfeiff.
L. clausseni (C. B. Clarke) H. Pfeiff.
L. comatus (Böcklr.) H. Pfeiff.
L. compositus H. Pfeiff.
L. cubensis Kükenth.
L. densifolius (Nees) O. Kuntze
L. distichophyllus (Böcklr.) H. Pfeiff.
L. glaziovii (Böcklr.) H. Pfeiff.
L. humilis (Nees) O. Kuntze
L. junciformis (Kunth) O. Kuntze
L. minarum (Nees) O. Kuntze
L. nudipes (C. B. Clarke) H. Pfeiff.
L. polyphyllus (Nees) O. Kuntze
L. triqueter (Böcklr.) O. Kuntze

All of these species except *L. cubensis* have been described from Brazil.

Didymiandrum Gilly, Bull. Torrey Club **68**: 330. 1941.

Plants dioecious, perennial with very short rhizomes. Culms erect, trigonous, many-noded, aphyllopodic with several bladeless cataphylls at base. Leaves of normal kind all on culms, making pseudowhorls of 2 or 3; blades lance-oblong; sheaths connate-margined without contra-ligule. Inflorescence consisting of many partial panicles arising from axils of upper leaves, with numerous branches and branchlets. Staminate spikelets oblong; glumes rather many, imbricate, the lower 5 to 8 empty, the others staminiferous; stamens 3 to a flower. Pistillate spikelets 1-flowered; pistil trigynous with ciliolate hypogynous squamellae; fructifications ovoid-globose; utricle adnate to achene in total part, beak short without cavity.

Type and sole species. *Didymiandrum stellatum* (Böcklr.) Gilly.

1. **Didymiandrum stellatum** (Böcklr.) Gilly, Bull. Torrey Club **68**: 331. 1941. Based on *Cryptangium stellatum* Böckeler.

Cryptangium stellatum Böckeler, Linnaea **38**: 421. 1874.
Acrocarpus stellatus Nees ex Böcklr., Linnaea **38**: 422. 1874. Nomen invalidum ex synonymis.
Lagenocarpus stellatus (Böckeler) O. Kuntze, Rev. Gen. Pl. **2**: 754. 1891.
Didymiandrum guaiquinimae Schnee, Bol. Soc. Venez. Cienc. Nat. **9**: 81. 1944. Syn. nov.

Type. "British Guiana" [Roraima, Venezuela], *Schomburgk 1227* (B).

Distribution. This species is rather common in the east half of the Roraima Sediment area from Cerro Sipapo eastwards to Pakaraima Mountains in British Guiana, thus the range resembles that of *Everardia montana* subsp. *montana* and *Cephalocarpus rigidus*. The following specimens have been examined including the type of synonymized names. VENEZUELA. Amazonas: Cerro Sipapo, *Maguire & Politi 27830* ♂, *27875* ♂, *27951* ♂ & ♀; Cerro Huachamacari, *Maguire, Cowan & Wurdack 30093* ♂; Cerro Duida, *B. Maguire & B. Maguire, Jr. 29170* ♂; Cerro Neblina, *Maguire, Wurdack & Bunting 36839* ♂, *Maguire, Wurdack & C. K. Maguire 42110* ♂; Bolívar: Cerro Guaiquinima, *Cardona 933* ♀

(VEN, holotype of *D. guaiquinimae;* NY, isotype, Alto Río Paragua, alt. 1300 m), *Maguire 33043* ♂; Auyán-tepuí, *Tate 1348* ♂; Uaipan-tepuí, *Phelps & Hitchcock 320* ♂; Chimantá Massif, *Steyermark 74668* ♂, *Steyermark & Wurdack 1001* ♂, *Wurdack 34054* ♂; Ptari-tepuí, *Steyermark 59464;* Ilu-tepuí, *Maguire 33479* ♂; Cerro Venamo, *Steyermark & Nilsson 86* ♂ & *116* ♂. BRITISH GUIANA. Pakaraima Mts., *Maguire & Fanshawe 32294* ♂; Kaieteur Plateau, *Maguire & Fanshawe 23230* ♂.

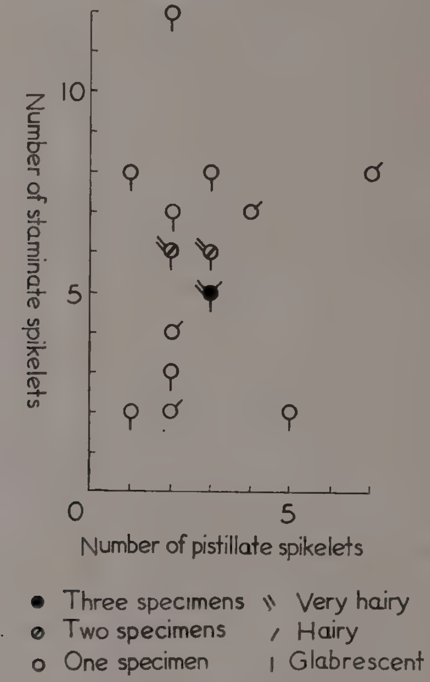

FIG. 9. Pictorialized scatterdiagram showing variation in *Exochogyne amazonica.* For marks see captions.

Schnee (1944) recognized three species in this genus, when he proposed *Didymiandrum guaiquinimae. D. flexifolium* is in this paper transferred to *Everardia.* Schnee's reason for establishing *D. guaiquinimae* is obscure as he merely stated as "comprende 3 especies que son endémicas en las montañas altas de la Guayana Venezolana. . . ." Examining an isotype of *D. guaiquinimae* we come to the conclusion that it is identical with *D. stellatum,* which is the sole species of the genus.

Exochogyne C. B. Clarke, Verh. Bot. Ver. Brandenb. **47**: 101. 1906.

Perennials. Rhizomes short-creeping, covered with scales more or less disintegrating into brown fibers. Leaves radical, linear, more or less hairy; sheaths connate, without contra-ligule. Culms central, scape-like. Inflorescence spike-like, consisting of several alternate partial inflorescences on more or less zigzag axis. Bracts long-bladed, all overtopping inflorescence; sheaths short, dilated. Spikelets (3–)4–11(–15), umbellate, all enclosed in bract sheaths. Staminate spikelets 2 to 12, subulate, sessile or on very short peduncle, several-flowered;

glumes 2-ranked, lance-oblong, hyaline, the lower two empty; stamens 2 to 6 to a flower. Pistillate spikelets 1 to 7, on unequal peduncles, ovate, 1-flowered; glumes ovate, hyaline; pistils digynous without hypogynous squamellae; fructifications elliptic-obovate or ovate-elliptic, bilaterally compressed, the utricle adnate to achene in total part, the beak very short.

Monotypic genus. Type species. *Exochogyne amazonica* C. B. Clarke.

Distribution. See Fig. 1, C.

1. **Exochogyne amazonica** C. B. Clarke, Verh. Bot. Brandenb. **47**: 101. 1906.

Lagenocarpus amazonicus (C. B. Clarke) H. Pfeiffer in Fedde, Repert. Sp. Nov. 21: 35. 1925.

Exochogyne megalorrhyncha Tutin, Hook. Ic. Plant. 33: *t. 3274.* 1935. Syn. nov.

Exochogyne decandra Tutin, Hook. Ic. Plant. 33: *t. 3275.* 1935. Syn. nov.

Exochogyne amazonica C. B. Cl. var. *esmeraldensis* Gilly, Fieldiana Bot. 28(1): 53. 1951. Syn. nov.

Exochogyne steyermarkii Gilly, Fieldiana Bot. 28(1): 53. 1951. Syn. nov.

TABLE 4

Characteristics in *Exochogyne amazonica.*

Specimens	Number of spikelets in an involucre		Number of stamens	Pubescence on bracts and leaves	Fruits	
	Pistillate	Staminate			Dimension	Beak
Venezuela:						
Duida, Steyermark 57805						
plant 1	2	3	3	–	2.0×1.0 mm	0.5 mm
plant 2	1	2	2	–		
Duida, Steyermark 57820	2	3	2	–	2.2×1.0 mm	0.5 mm
Bolívar:						
Río Chicanán, Steyermark 89696						
plant 1	3	6	2	++	2.3×1.2 mm	0.3 mm
plant 2	2	6	2	++	2.2×1.0 mm	0.5 mm
plant 3	3	5	2	++	2.0×1.2 mm	0.5 mm
Río Cuyuni, Maguire et al. 53554						
plant 1	7	8	2	+	2.7×1.0 mm	1.0 mm
plant 2	4	7	4	+	2.5×1.2 mm	1.0 mm
plant 3	2	4	2	+		
Cerro Piton, Maguire et al. 53650	5	2	2	–	(immature)	
British Guiana:						
Kaieteur Savanna, Sandwith 1405						
plant 1	3	5	4	+	(immature)	
plant 2	2	2	2	+		
Suriname:						
Tafelberg, Maguire 24433						
plant 1	3	5	2	–	(immature)	
plant 2	2	6	2	–		
plant 3	2	7	4	–		
Tafelberg, Maguire 24601						
plant 1	2	2	?2	+	(immature)	
plant 2	3	6	2	–		
Brazil:						
Cachoeiras, Ule 6128						
plant 1	3	8	6	–	(immature)	
plant 2	2	12	6	–		
plant 3	1	8	4	–		

Type. Campinas near Cachoeiras de Marmellos, a tributary of the Madeira, Amazonas, Brazil. *E. Ule 6128* (K, holotype; B, isotype).

Distribution. Known from relatively few localities in eastern Guayana from Cerro Duida eastwards to Tafelberg in Suriname and southwards to the Río Negro Valley. VENEZUELA. Amazonas: between Esmeralda Savanna and southeastern base of Cerro Duida, alt. 200 m, *Steyermark 57805* (F, holotype of *E. amazonica* var. *esmeraldensis;* NY, isotype); between Esmeralda Savanna and southeastern base of Cerro Duida, in swampy woods, alt. 200 m, *Steyermark 57820* (F, holotype of *S. steyermarkii;* NY, photo). Bolívar: Sabana de Triana, Río Chicanán, 50 km SE of El Dorado, alt. 300 m, *Steyermark 89696;* Alto Río Cuyuni, Río Chicanán, in savannas 2 km S of Río Chibau, at alt. 100 m, *Maguire, Steyermark & Maguire 53554;* infrequent in savanna thickets, on SE escarpment of Cerro Piton, alt. 400 m, Cordillera Epicara, *Maguire, Steyermark & Maguire 53650.* BRITISH GUIANA. Potaro River, Kaietuk Savannah, in rather open dry sandy ground, *Tutin 634* (BM, holotype of *E. megalorrhyncha;* K, isotype); Kaieteur Savanna, on sphagnum and damp sandy ground, ca. alt. 1200 ft, *Sandwith 1405* (K, NY). SURINAME. Tafelberg: small savanna NW of Savanna No. VIII, *Maguire 24433;* grassy area in small rock savanna, low bush 0.5 km NW of Savanna No. VIII, alt. 760 m, *Maguire 24601.*

In the genus *Exochogyne* four names have been proposed, viz. *E. amazonica, E. decandra, E. megalorrhyncha,* and *E. steyermarkii.* We interpret all of them as representing the same taxon, of which the correct name should be *E. amazonica.* Tutin, who is responsible for two of these names, is of opinion that species of *Exochogyne* can be discerned by the mode of pubescence of leaves and the number of staminate and pistillate spikelets in an involucre. He then segregated *E. decandra* from *E. amazonica* by the number of staminate and pistillate spikelets that are 10 vs. 6 and 3 vs. 2 respectively. *E. megalorrhyncha* Tutin was separated from the above two chiefly by the long-pilose leaves, as contrastive with glabrous or nearly glabrous ones, and by the number of staminate spikelets that is 2 to 4 vs. 6 to 10. The last name, *E. steyermarkii* Gilly, was said to differ from *E. megalorrhyncha* in "glabrity" of habit. But as shown in the scatter diagram of Fig. 9 and in Table 4, columns 1 and 3, none of these characters is clearcut, nor is there any correlation between the mode of pubescence and the number of staminate and pistillate spikelets in an involucre. Furthermore, we have also investigated the variability in the number of stamens in a flower and fruit size (see Table 4, columns 2 and 4), which we found useless for making taxonomic distinction.

CYPERACEAE TRIBE SCLERIEAE [22]

Scleria Bergius, Vet. Akad. Handl. Stockh. **26**: 142. 1765.

Hypoporum Nees, Linnaea 9: 303. 1834.
Hymenolytrum Schrader ex Nees, Fl. Bras. 2(1): 147. *t. 22.* 1842.
Chondrolomia Nees, Fl. Bras. 2(1): 173. 1842.
Macrolomia Schrader ex Nees, Fl. Bras. 2(1): 181. *t. 24.* 1842.
Omoscleria Nees, Fl. Bras. 2(1): 180. 1842.
Mastigoscleria Nees, Fl. Bras. 2(1): 177. 1842.
Ophryoscleria Nees, Fl. Bras. 2(1): 182. *t. 25.* 1842.
Schizolepis Schrader ex Nees, Fl. Bras. 2(1): 169. *t. 25.* 1842.
Trachylomia Schrader ex Nees, Fl. Bras. 2(1): 174. 1842.

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[22] By Earl L. Core, Department of Biology, West Virginia University.

Type. *Scleria flagellum-nigrorum* Bergius.

The name "Scleria," derived from the Greek σκληρια, hardness, in allusion to the indurated fruits, was first used for these plants in 1765 by Peter Jonas Bergius. Previous to that time, however, certain species of the genus had been described as members of other genera. The earliest mention of any plant which may with certainty be placed in this genus was in 1707, when Hans Sloane described and figured a Jamaican plant which he called *Gramen cyperoides sylvaticum maximum geniculatum asperius, semine milii folis*. This is clearly the plant now known as *Scleria secans*.

Scleria lithosperma, the most widely distributed species of the genus, was first described by Linnaeus in 1753 as *Scirpus lithospermus*. In 1762 he transferred the plant to the genus *Schoenus*, but it was not placed in *Scleria* until 1788 by Swartz. The second plant to be described and named was the one now known as *Scleria secans*, originally placed by Linnaeus in *Schoenus*.

The genus retained its integrity until 1834, when Nees separated the species with a minute or obsolete hypogynium under the name *Hypoporum*. Eight years later Nees carried this dismemberment to a point where the genus *Scleria* proper was reduced to only a few species and the majority of the American species were rather artificially segregated under the new genera *Hymenolytrum, Chondrolomia, Macrolomia, Omoscleria, Mastigoscleria, Ophryoscleria, Schizolepis,* and *Trachylomia*.

Hymenolytrum was characterized by Nees in his key to the genera as follows: "Spiculae femineae in eodem ramulo inferae, sessiles, uniflorae, masculae pedunculatae. Cupula pateriformis, stipitata. Perigynium membranaceo-trilobum lobis parvis distantibus." The name is retained in the present treatment as a section. The ten species known to belong to the group have tall stems and broad leaves with the very numerous spikelets densely clustered in pyramidal panicles.

The genus *Chondrolomia* was founded on *Scleria sellowiana*, a species of southern Brazil bearing six tubercles on the hypogynium. It is clearly a member of the Tuberculatae series of the Euscleriae.

Macrolomia, as a genus, was erected for *Scleria bracteata*, a tropical American species with the pistillate spikelets distinctly segregated in the lower portion of the panicle and the staminate spikelets in the upper portion. This arrangement is unknown among the other American species, but from the fruit characters and the general appearance of the plant it belongs in the section *Scleria*.

Omoscleria was founded on *Scleria flagellum* Sw., and *Mastigoscleria* on *S. reflexa* HBK. Both of these genera were based on artificial characters which do not differ widely from the general characters of the genus.

Ophryoscleria was characterized by Nees in his key as: "Cupula cum perigynio connata, profunde excavata, truncata, crassa, a perigynio ciliata." The eleven members of this section, as recognized in this treatment, are quite distinct in their habit and in general are identified by the ciliate margin of the hypogynium. The fact that this is essentially glabrous in *S. schiedeana* does not militate against its inclusion here, since the vegetative appearance of that plant clearly places it with the *Ophryoscleriae*.

Schizolepis was briefly characterized by Nees as follows: "Disci margo fimbriatus aut alte serratus." This section comprises eleven species, having the margin of the hypogynium deeply serrate or fimbriate.

Trachylomia was founded on *S. triglomerata* and is not separated from *Scleria* proper by characters of generic rank.

In the present treatment some of these are retained as names of sections of

Scleria. The American species are grouped into the five sections, *Hypoporum, Ophryoscleria, Hymenolytrum, Schizolepis,* and *Scleria,* all of which are represented in the Guayana region.

Specimens studied in the preparation of this paper are from the herbarium of The New York Botanical Garden, the National Herbarium (Smithsonian Institution), the Gray Herbarium, Missouri Botanical Garden, Botanischer Garten (Berlin-Dahlem), Chicago Natural History Museum, the herbarium of West Virginia University, and the Instituto Botanico, Caracas. Gratitude is expressed to administrators of these herbaria for their assistance in making the material available.

Key to the Species of *Scleria*

1. Hypogynium obscure or none (sect. *Hypoporum*).
  2. Inflorescence simple, glomerate-spicate.
    3. Achene essentially smooth. 2. *S. hirtella.*
    3. Achene reticulate or verrucose.
      4. Bracts glabrous. 3. *S. verticillata.*
      4. Bracts hirsute. 1. *S. interrupta.*
  2. Inflorescence more or less branched.
    5. Achene smooth.
      6. Achene depressed-globose, 1 mm long; plant glabrous. 4. *S. purdiei.*
      6. Achene 2–2.5 mm long; inflorescence loosely few-flowered. 5. *S. lithosperma.*
    5. Achene strongly verrucose tuberculate. 6. *S. micrococca.*
1. Hypogynium present.
  7. Pistillate spikelets lowest in each branch, sessile, one-flowered, the staminate on distinct long peduncles (sect. *Hymenolytrum*).
    8. Contra-ligule unappendaged.
      9. Leaves 7–20 mm wide.
        10. Inflorescence straw-colored; hypogynium-lobes pronounced. 10. *S. cyperina.*
        10. Inflorescence purplish; hypogynium-lobes none or obscure. 11. *S. tepuiensis.*
      9. Leaves 18–45 mm wide.
        11. Panicles dense, mostly straw-colored. 12. *S. grandis.*
        11. Panicles open, purplish. 13. *S. venezuelensis.*
    8. Contra-ligule with a very large membranaceous appendage.
      12. Leaves 30–40 mm wide. 14. *S. stipularis.*
      12. Leaves 5–20 mm wide.
        13. Hypogynium-margins horizontal, lobes none or very obscure. 15. *S. ramosa.*
        13. Hypogynium distinctly 3 lobed, the lobes lanceolate.
          14. Hypogynium-lobes entire. 16. *S. macrogyne.*
          14. Hypogynium-lobes dissected. 17. *S. cyperinoides.*
  7. Without this combination of characters.
    15. Hypogynium-margin ciliate, fimbriate, or serrate.
      16. Hypogynium ciliate on the margin (sect. *Ophryoscleria*).
        17. Achene very large, 3.5–6 mm long. 7. *S. macrophylla.*
        17. Achene smaller, 1–3 mm long.
          18. Achene 1–2 mm long; leaves 7–11 mm wide. 8. *S. microcarpa.*
          18. Achene 2–3 mm long; leaves 10–30 mm wide. 9. *S. mitis.*
      16. Hypogynium-margin fimbriate or serrate (sect. *Schizolepis*).
        19. Achene small, 2 mm long. 18. *S. camaratensis.*
        19. Achene larger.
          20. Leaves 20–50 mm wide; achenes smooth.
            21. Inflorescence and achenes purplish-violet. 19. *S. arundinacea.*
            21. Inflorescence brown-stramineous; achenes white. 20. *S. latifolia.*
          20. Leaves 12–20 mm wide; achenes rugose. 21. *S. acanthocarpa.*
    15. Hypogynium three-lobed, the lobes entire (sect. *Scleria*).
      22. Upper part of the panicle bearing only staminate spikelets, lower part bearing only pistillate spikelets. 22. *S. bracteata.*
      22. Staminate and pistillate spikelets intermixed throughout the inflorescence.
        23. Achene verrucose, reticulate, or papillate.

24. Leaves 8–24 mm wide. 23. *S. parallela.*
24. Leaves 1–7 mm wide.
25. Culms muricate-scabrous on the angles. 25. *S. tenacissima.*
25. Culms smooth or only slightly roughened on the angles.
26. Annual, with fibrous roots. 24. *S. muhlenbergii.*
26. Perennial by rootstocks 26. *S. lagoensis.*
23. Achene smooth.
27. Achene purple-violet or variegated with white.
28. Angles of the sheaths broadly winged. 27. *S. vaginata.*
28. Angles of the sheaths narrowly winged or wingless.
29. Leaf-sheaths more or less wooly-pubescent. 28. *S. flagellum-nigrorum.*
29. Leaf-sheaths glabrous. 29. *S. melaleuca.*
27. Achene white.
30. Contra-ligule with a conspicuous scarious appendage; plant climbing. 31. *S. secans.*
30. Contra-ligule unappendaged.
31. Sheaths broadly winged. 27. *S. vaginata.*
31. Sheaths wingless or nearly so. 30. *S. pterota.*

1. Scleria interrupta Rich. Act. Soc. Hist. Nat. Paris **1**: 113. 1792.

Hypoporum interruptum Nees, Linnaea **9**: 303. 1834. Based on *Scleria interrupta* Rich.
Hypoporum distans Nees in Mart., Fl. Bras. 2(1): 171 (in note). 1842 (*fide* Clarke, Symb. Ant. 2: 139. 1900).
Scleria hirtella var. *β* Boeck. Linnaea **38**: 440. 1874.
Scleria distans var. *interrupta* Kukenth. Repert. Sp. Nov. **23**: 214. 1926. Based on *Scleria interrupta* Rich.

Type locality. French Guiana (*Leblond*).

Distribution. Savannas and pinelands, West Indies to Central America, Venezuela and Brazil. VENEZUELA. Lara: Sabanas de Cujicito, 300–450 m, *Saer 443.*

2. Scleria hirtella Sw. Prodr. Veg. Ind. Occ. 19. 1788.

Carex hirtella Gmel. Syst. Nat. 2: 138. 1791. Based on *Scleria hirtella* Sw.
Scleria interrupta Michx. Fl. Bor. Am. 2: 168. 1803; not Rich. Act. Soc. Hist. Nat. Paris 1: 113. 1792. ''Carolina ad Floridam.''
Cenchrus hirsutus Spring. Neue. Entdeck. 3: 15. 1822 (*fide* Kunth, Enum. Pl. 1: 166. 1833). Type locality Hispaniola.
Hypoporum humile Nees, Linnaea **9**: 303. 1834.
Hypoporum hirtellum Nees, Linnaea **9**: 303. 1834 (*fide* Britton, Ann. N. Y. Acad. Sci. **3**: 236. 1885).
Hypoporum interruptum Torrey, Ann. Lyc. N. Y. **3**: 382. 1836. Based on *Scleria interrupta* Michx.
Scleria cenchroides Kunth, Enum. Pl. **2**: 352. 1837 (*fide* Boeck. Linnaea **38**: 440. 1874). ''Cap. b. spei; ad oram orientalem legit Drege.''
Scleria hirta Willd.; Kunth, Enum. Pl. **2**: 352, in syn. 1837. ''Willd. herb. n. 17329 (forma fructu laevi).''
Scleria mollis Kunth, Enum. Pl. **2**: 352. 1837. (*fide* Boeck. Linnaea **38**: 440. 1874). ''Brasilia meridionalis.''
Scleria nutans Willd.; Kunth, Enum. Pl. **2**: 351. 1837 (*fide* Britton, Ann. N. Y. Acad. Sci. **3**: 235. 1885). ''Guiana, Brasilia, Chili, Mexico.''
Scleria interrupta Kunth. Enum. Pl. **2**: 352, in part (as to syn. *S. hirta*). 1837.
Scleria pulchella Nees in Mart., Fl. Bras. 2(1): 170, in syn. 1842.
Anerma hispidula Schrad. in sched., *fide* Nees, in Martius, Fl. Bras. 2(1): 170. 1842.
Hypoporum nutans Nees in Mart., Fl. Bras. 2(1): 170. 1842. Based on *Scleria nutans* Kunth.
Scleria michauxii Chapm. Fl. S. U. S. 532. 1860. Based on *Scleria interrupta* Michx.
Scleria hirtella var. *pauciciliata* Britton, Ann. N. Y. Acad. Sci. **3**: 236. 1885.

Scleria humilis Britton, Ann. N. Y. Acad. Sci. 3: 235. 1885. Here ascribed to Nees (Linnaea 9: 303. 1834.), who did not make this combination.

Type locality. Jamaica.

Distribution. Wet grassy lands, pine barrens and savannas, southern United States to northern Argentina and Chile; also in Africa. VENEZUELA. Anzoategui: Near El Tigrito, *Pittier 14310;* near Santome, *Pittier 14759.* Aragua: Alto de Nor Leon, *Pittier 8047.* Bolívar: slopes of Mt. Roraima, alt. 1675 m, *Steyermark 58622;* near Hato de Muria, alt. 400 m, *Steyermark 88687, 88719.* Distrito Federal: Upper Cotiza, near Caracas, *Pittier 7368.* Lara: Between Buenos Aires and Canyon of El Callado, alt. 2285–2740 m, *Steyermark 55536.* Merida: Pueblos del Sur, *Bernardi 2280;* Tabay, alt. 1800–2200 m, *Gehriger 437a;* north of Merida, *Vareschi 348;* Tabay, Río Chama, *Steyermark 57049;* Llano Grande, Merida, *Lasser 278;* Tovar, *Fendler 1582, 8047.* Miranda: Los Teques, *Badillo 203;* Turmerito, *Badillo 208.* Monagas: Northwest of Caripe, *Steyermark 61820.* Nueva Esparta: Margarita Island, *Johnston 312.* Sucre: Headwaters of Río de Amana, alt. 2000 m, *Steyermark 62712.* BRITISH GUIANA. Mt. Roraima, Arubupu, *Tate 233; Schomburgk 647;* Mt. Roraima, *Jenman 248.*

3. **Scleria verticillata** Muhl.; Willd. Sp. Pl. **4**: 317, excl. syn. Michx. 1805.

Hypoporum verticillatum Nees, Linnaea 9: 303. 1834. Based on *Scleria verticillata* Muhl.
Hypoporum diffusum Nees, Linnaea 9: 303. 1834. *fide* Boeck. Linnaea 38: 446. 1874.
Scleria diffusa Michx; Kunth, Enum. Pl. 2: 359. 1837. Based on *Hypoporum diffusum* Nees.
Scleria tenuiflora Willd.; Kunth, Enum. Pl. 2: 353. 1837, in syn. ''Willd. herb. n. 17331 e Sierra Leona, (an patria recte notata?)''
Scleria tenella Kunth, Enum. Pl. 2: 353. 1837. Type locality, Guiana.
Hypoporum tenellum Nees in Mart., Fl. Bras. 2(1): 171. 1842. Based on *Scleria tenella* Kunth.
Scleria kunthiana Steud. Syn. Pl. Cyp. 176. 1855.
Scleria hirtella var. *glabrescens* Boeck. ms. in *C. Wright 3417* (*fide* Clarke, Symb. Ant. 2: 139. 1900).
Scleria verticillata f. *brevis* Kukenth. Repert. Sp. Nov. 23: 214. 1926. Type locality, Cuba: prov. Pinar del Río, Herradura (*Ekman 17730,* Oct. 21, 1923.)
Scleria verticillata f. *capillaris* Kukenth. Repert. Sp. Nov. 23: 214. 1926. Type locality, Cuba: prov. Pinar del Río, Laguna Santa Maria (*Ekman 17275,* 23 Aug 1923).
Scleria verticillata var. *tenella* Kukenth. Bot. Jahrb. 56: Beibl. 125: 20. 1921. Type locality, Brazil: Rio Branco, Serra do Mel (*Ule 8063,* in part).

Type locality: Virginia, Carolina.

Distribution. Wet sandy soil and cultivated ground, Ontario to Florida, Texas, Mexico, Bahamas, Cuba, Venezuela, and Brazil. VENEZUELA. Merida: *Gehriger 555.* BRITISH GUIANA. Waranama Ranch, Berbice River, *Persaud & Harrison 1137, 960;* St. Ignatio, Rupununi, *Harrison 1293;* Upper Mazaruni River, Imbaimadai Savannah, (US) #*388,* no collector named.

4. **Scleria purdiei** Clarke, Kew Bull. Add. Ser. **8**: 57. 1908.

Scleria hitchcockii Standley, Contr. U. S. Nat. Herb. 18: 88. 1916.

Type locality. ''Colombia, Guanaguena, *Moritz 643* (1258) (hb. Berol.); S. Marta, *Purdie* (hb. Kew); *Moritz,* no. 1911, 1590 partim (hb. Mus. Brit.).''

Distribution. Savannas and selvas, Mexico to Colombia and Venezuela. VENEZUELA. Bolívar: Gran Sabana, in woods bordering Río Kukenan, *Steyer-*

mark 58540. Distrito Federal: Sabanas de S. Lazaro, *Pittier 9767;* Sabanas de Cotiza, *Pittier 7357*.

5. **Scleria lithosperma** (L) Sw. Prodr. Veg. Ind. Occ. 18. 1788.

Scirpus lithospermus L. Sp. Pl. 51 in part. 1753. ''Habitat in India.''
Schoenus lithospermus L. Sp. Pl. ed. 2. 65 in part. 1762. ''India occidentalis''; based on *Scirpus lithospermus* L.
Scleria tenuis Retz. Obs. 4: 13. 1786 (*fide* Boeck. Linnaea 38: 452. 1874).
Scleria filiformis Sw. Prodr. Veg. Ind. Occ. 19. 1788. Type locality, West Indies.
Carex subulata Gmel. Syst. Nat. 2: 138. 1791. Based on *Scleria filiformis* Sw.
Carex tenuis Gmel. Syst. Nat. 2: 138. 1791. Based on *S. tenuis* Retz.
Carex lithosperma Gmel. Syst. Nat. 2: 137. 1791. Based on *Scirpus lithospermus* L.
Scleria gracilis Rich. Act. Soc. Hist. Nat. Paris 1: 113. 1792 (*fide* Willdenow). Type locality, French Guiana (*Leblond*).
Scleria purpurea Poir. in Lam. Encyc. 7: 4. 1806 (*fide* Kunth, Enum. Pl. 2: 348. 1837). ''Cette plante croît en Amérique, a L'ile Saint-Thomas.''
Scleria capillaris R. Br. Prodr. 240. 1810 (*fide* Boeck. Linnaea 38: 453. 1874).
Scleria glaucescens Presl. Rel. Haenk. 1: 202. 1828 (*fide* Nees, in Wight, Contrib. Bot. 117. 1834). ''Hab. in insula Luzon.'' (*Haenke*).
Scleria elongata Presl. Rel. Haenk. 1: 202. 1828. ''Hab. ad portum Acapulco in regno Mexicano'' (*Haenke*).
Hypoporum purpurascens Nees, Linnaea 9: 303. 1834 (*fide* Kunth, Enum. Pl. 2: 348. 1837).
Hypoporum sieberi Nees, Linnaea 9: 303. 1834 (*fide* Boeck, Linnaea 38: 453. 1874).
Hypoporum capillare Nees, Linnaea 9: 303. 1834 (*fide* Boeck, Linnaea 38: 453. 1874).
Scleria subulata Steud. Nomencl. ed. 2. 1: 296. 1840. Based on *Carex subulata* Gmel.
Scleria wightiana Steud. Syn. Pl. Cyp. 176. 1855.
Scleria lithosperma var. *filiformis* Britton, Ann. N. Y. Acad. Sci. 3: 231. 1885. Based on *Scleria filiformis* Sw.
Scleria krugiana Boeck. Cyp. Nov. 1: 35. 1888. Type locality, Porto Rico (*Sintenis 4945*).
Hypoporum lithospermum Nees; B. D. Jackson, Ind. Kew 1: 1198. 1895. Based on *Scleria lithosperma* Sw.

Type locality. India.

Distribution. Dry thickets and open woods, especially on limestone, in nearly all tropical maritime regions. VENEZUELA. Bolívar: West of Upata 5 km, *Steyermark*. Nueva Esparta: Margarita Island, *Johnston 328*.

6. **Scleria micrococca** (Liebm.) Steud. Syn. Pl. Cyp. 179. 1855.

Hypoporum micrococcum Liebm. Vidensk. Selsk. Skr. V. 2: 256. 1850. ''Samlet i törre Savaner ved Segovia i Nicaragua af Mag. Ørsted i Januar.''
Hypoporum purpurascens Liebm. Vidensk. Selsk. Skr. V. 2: 256. 1850; not Nees, Linnaea 9: 303. 1834. ''Voxer i torre Savaner ved Mirador i Potrero de Consoquitla, blomstrende i October; ligeledes i Dep. Oajaca ved Talea i August'' (*Ørsted*).
Scleria liebmanni Steud. Syn. Pl. Cyp. 179. 1855. Based on *Hypoporum purpurascens* Liebm.
Hypoporum verticillatum Nees, Bonplandia 3: 87. 1855; not Nees, Linnaea 9: 303. 1834.
Scleria tenella Griseb. Cat. Pl. Cub. 249, in part. 1866; not Kunth, Enum. Pl. 2: 353. 1837.
Scleria luzulaeformis Wright; Sauv. Anal. Acad. Cienc. Habana 8: 156. 1871. ''En sabana cerca de San Juan de Buena Vista, jurisdiccion de Bayamo.'' (*Wright 3418* pp.).
Scleria costaricensis Boeck. Alg. Bot. Zeitschr. 2: 157. 1896. ''Entre Terraba et Boruca, Costa Rica'' (*Tonduz 4634*).

Type locality. Nicaragua.

Distribution. Wet fields, Mexico and Cuba to Central America, Colombia, Venezuela, and Brazil. VENEZUELA. Amazonas: Sacariaco, *Steyermark 58490*. Bolívar: Gran Sabana, between Divina Pastora and Santa Elena, S of Roraima, *Steyermark 59297;* Auyán-tepuí, *Tate 1198*. Guarico: Estacion Biologica de Los Llanos, Calabozo, *Blydenstein 281*.

7. **Scleria macrophylla** Presl, Rel. Haenk. **1**: 200. 1828.

Scleria paludosa Poepp. & Kunth; Kunth, Enum. Pl. 2: 344. 1837. "Peruvia (prope Tocache, ad fl. Huallagum superiorem, in sylvis paludosis) Poeppig legit."

Ophryoscleria paludosa Nees in Mart., Fl. Bras. 2(1): 185. 1842. Based on *Scleria paludosa* Poepp. & Kunth.

Scleria palmifolia Hoffmgg.; Schlecht. Bot. Zeit. 3: 492. 1845. (*fide* Boeck. Linnaea **38**: 522. 1874). "Salzm. hrbr. Bahia."

Scleria macrocarpa Salzm.; Schlecht. Bot. Zeit. **3**: 492, as syn. 1845.

Ophryoscleria asperrima Liebm. Vidensk. Selsk. Skr. V. 2: 261. 1851. "Et Exemplar hjembragtes af Mag. Ørsted, samlet ved Bredderne af Rio de S. Juan de Nicaragua i Juni."

Scleria asperrima Steud. Syn. Pl. Cyp. 170. 1855. Based on *Ophryoscleria asperrima* Liebm.

Type locality. "In insula Luzon" (*Haenke*), in error; probably tropical South America.

Distribution. Marshes and swampy forests, Mexico to Colombia, Venezuela, Brazil, and Bolivia. VENEZUELA. Amazonas: Alto Orinoco, edge of Yapacama Savanna, *Maguire & Wurdack 34555;* Alto Orinoco, Cerro Yapacama, *Maguire & Wurdack 34543.* Apure: Río Parguaza, *Velez 2346.* BRITISH GUIANA. Northwest District, Waini River, Marabo Shortcut, *De La Cruz 1285;* Demerari River, *Jenman 6091;* Coast land, Berbice, *Jenman 5624.*

8. **Scleria microcarpa** Nees, Linnaea **9**: 302. 1834.

Scleria ovuligera Reichb.; Nees, Linnaea 9: 303. 1834 (*fide* Kunth, Enum. Pl. 2: 341. 1837).

Ophryoscleria microcarpa Nees in Mart., Fl. Bras. 2(1): 184. 1842. Based on *S. microcarpa* Nees.

Scleria foliosa Wright; Sauv. Anal. Acad. Cienc. Habana **8**: 154. 1871; not A. Rich Tent. Fl. Abyss. 2: 509. 1851. Type locality, Cuba (*Wright 3807*).

Scleria latifolia Balb.; Boeck. Linnaea **38**: 517, as syn. 1874.

Scleria microcarpa var. *latifolia* Boeck. Linnaea **38**: 517. 1874. Type locality, Guadeloupe.

Scleria microcarpa var. *foliosa* Clarke. Symb. Ant. **2**: 149. 1900.

Type locality. Brazil.

Distribution. Swamps, roadsides, and moist thickets, Mexico, Central America, Cuba and throughout tropical South America to Paraguay. VENEZUELA. Amazonas: Tamatama, Río Orinoco, *Holt & Gehriger 264–279* ("NGS," i.e., National Geographic Society); Río Castanho, *Cardona 1440;* San Antonio, Río Orinoco, between Río Cunucunúma and Ventuari, *Maguire, Cowan & Wurdack 30460A.* Anzoategui: Near Santome, *Pittier 15134;* along highway 33 km S of Barcelona, *Steyermark 93050.* Apure: Region of Cunaviche, *Borsotti 101.* Barinas: Los Mangos, *Ramia 1748.* Bolívar: Laguna las Delicias, Gran Sabana, alt. 900 m, *Tamayo 2778;* Sabana de El Figu, Rio Cuchivero, *Williams 13369;* La Union, Medio Caura, alt. 80 m, *Williams 11250;* Cerro El Picacho and vicinity, Altiplanicie de Nuria, *Steyermark 88782;* Chimantá Massif, *Steyermark & Wurdack 149.* Delta Amacuro: *Gines 5032.* Lara: Palmasola, *Pittier 6382.* Trujillo: Pto. La Ceiba, Lake Maracaibo, *Aristeguieta 4072.* BRITISH GUIANA. *Jenman 6089; Schomburgk 660;* Potaro Landing, *Gleason 472;* Kurupung, upper Mazaruni River, *Leng 249;* Wanama River, Northwest District, *De La Cruz 3941;* Basin of Essequibo River, near mouth of Onoro Creek, *Smith 2809;* Demerara, *For. Dept. F 3079;* East Coast Water Conservancy, Lamaha Stop-off, *Hitchcock 16866;* Kamakusa, *Leng 34;* Barima River, *Jenman 7063.*

9. **Scleria mitis** Bergius, Vet. Akad. Handl. Stockh. **26**: 145. *pl. 5.* 1765.

Schoenus lithospermus L. Sp. Pl. ed. 2. 65, pro parte. 1762 (*fide* Clarke, Symb. Ant. 2: 150. 1900).

Carex lithosperma L. Syst. Veg. et. 13. 706. 1774 (*fide* Clarke, Symb. Ant. 2: 150. 1900).

Carex mitis Gmel. Syst. Nat. 2: 138. 1791. Based on *S. mitis* Berg.

Scleria riparia Poepp. & Kunth; Kunth, Enum. Pl. 2: 341. 1837. "Peruvia (prope Tocache, mission del Huallaga alto, in fluviorum ripis paludosis) *Poeppig* legit."

Scleria latifolia Reichb.; Nees in Mart., Fl. Bras. 2(1): 183, as syn. 1842. "Specimen majus ante anthesin decreptum."

Ophryoscleria lucida Nees in Mart., Fl. Bras. 2(1): 183. 1842. "In silvis prov. S. Pauli et Rio de Janeiro; in campis altis do Paranan et in silvis Minarum Novarum (*Martius*); in Gujana (*Weigelt*)."

Ophryoscleria mitis Nees in Mart., Fl. Bras. 2(1): 183. 1842. Based on *Scleria riparia* Poepp. & Kunth.

Scleria praealta Salzm.; Schlecht. Bot. Zeit. 3: 461, as syn. 1845. "In paludosis Bahia."

Scleria lucida Steud. Syn. Pl. Cyp. 168. 1855. Based on *Ophryoscleria lucida* Nees.

Scleria trialata Bertero; Boeck. Linnaea 33: 521, as syn. 1874.

Scleria trinitatis Boeck. Cyp. Nov. 2: 31. 1890 (*fide* Clarke, Symb. Ant. 2: 150. 1900). "Insula Trinitatis."

Type locality. "Habitat in Surinamo."

Distribution. Clearings and wet banks, Guatemala and Cuba throughout tropical South America to Bolivia and Paraguay. VENEZUELA. Bolívar: La Paragua, *Killip 37591;* Cuidad Bolívar, *Bailey & Bailey 1363, 1684;* Caicara, *Haman 8.* Delta Amacuro: Lower Orinoco, *Rusby & Squires 333.* BRITISH GUIANA. *Jenman 6090;* Pomeroon River, Pomeroon District, *De La Cruz 3045, 3192;* Mazaruni Station, *Sandwith 1581;* Bartica, *Hitchcock 17263;* Berbice, *Jenman 5624.*

10. **Scleria cyperina** Kunth, Enum. Pl. **2**: 345. 1837.

Hymenolytrum cyperinum Nees in Mart., Fl. Bras. 2(1): 175. 1842. Based on *Scleria cyperina* Kunth.

Scleria cyperina var. *dentata* Pfeiff. Rep. Spec. Nov. 52: 169. 1943. "Venezuela to Bolivia and Brazil."

Type locality. Venezuela, "Cumana. Humb[oldt]. legit."

Distribution. Savannas, Colombia and Venezuela to Guiana and northern Brazil. VENEZUELA. Amazonas; Puerto Sanariapo, *Holt & Gehriger 215* ("NGS," i.e., National Geographic Society, Jan. 12, 1930); Sanariapo, alt. 120 m, *Williams 13071;* western foothills of Serra Imeri, near Salto de Hua, *Holt & Blake 478* (Plants of the Brazilian-Venezuelan Boundary, National Geographic Society); Serranía Parú, Río Parú, Caño Asísa, Río Ventuari, *Cowan & Wurdack 31379.* Bolívar: Sta. Elena, Gran Sabana, *Tamayo 2702;* foot of Auyán-tepuí, alt. 460 m, *Vareschi & Foldats 4528;* slope of Auyán-tepuí, alt. 1100 m, *Vareschi & Foldats 4609;* between Ciudad Bolívar and El Cristo, *Killip 37236;* Sta. Elena, Gran Sabana, *Lasser 1289;* base of Carrao-tepuí, alt. 1460–1615 m, *Steyermark 60846;* Canaima, Quezada; El Dorado hacia Sta. Elena, *Foldats 2661;* El Dorado, *Aristequieta 3755;* Río Uarama, below Uarama-tepuí, *Steyermark & Nilsson 650;* between Ciudad Bolívar and El Cristo, *Killip 37236;* Ilu-tepuí, Gran Sabana, *Maguire 33734;* Roraima, *Steyermark 59031;* Cerro Perro, Alto Río Paragua, *Cardona 731;* Cerro Venamo, near British Guiana border, *Steyermark, Dunsterville & Dunsterville 92306.* BRITISH GUIANA. Paramacutoi savanna, Ireng District, *Alston 510; Schomburgk 631.*

11. **Scleria tepuiensis** Core, Fieldiana Bot. **28**: 52. 1951.

Type locality. Summit of Cerro Duida, Savanna Hills, Venezuela, alt. 1025–1200 m, *Steyermark 58232.*

Distribution. At fairly high elevations on sandstone mesas, or tepuis, Venezuela and British Guiana. VENEZUELA. Amazonas: Summit of Cerro Duida, Savanna Hills, alt. 1025–1200 m, *Steyermark 58232* (type); in laterite, dry slopes of Savanna Hills, summit of Mt. Duida, *Tate 738;* Cerro Sipapo (Paraque), *Maguire & Politi 27816* (in part), *28145.* BRITISH GUIANA. Mt. Roraima, *Tate 152.*

12. **Scleria grandis** Core, Jour. Wash. Acad. Sci. **35**: 322. 1945.

Type locality. Selva del Tui-Igarape, alt. 200 m, cerca de Mitu, Vaupés, Colombia, *Cuatrecasas 6870* (type in Natl. Herb.).

Distribution. Selvas, Colombia, Venezuela, Guiana, and northern Brazil. VENEZUELA. Amazonas: Cerro Sipapo (Paráque), *Maguire & Politi 27816, 27924;* Ríos Pacimoni-yatua, Casiquiare, *Maguire, Wurdack & Bunting 37465.* Bolívar: Cerro Uroi, Río Uroi, *Maguire, Steyermark & Maguire 53721.*

13. **Scleria venezuelensis** Core, sp. nov.

Rhizomate non vidi; culmo 2–3 m alto, robusto, triquetro; foliis 20–40 cm longis, 2–4 cm latis, rigidis, supra scabris, cucullatis; vaginis glabris, triquetris, amplis; contra-ligula abbreviata, rotundata; paniculis 8–15 cm longis, purpurascentibus, laxis; bracteis foliaceis; spiculis masculis longe pedicellatis, numerosis; spiculis foemineis paucis, in ramorum basi subsessilibus; squamis masculis anguste mucronatis; squamis foemeneis ovatis; hypogynio sine lobis; achaenio albo, 2 mm longo, tuberculato, hirtello, obtuse trigono. *Scleriae grandis* proxime affinis.

Type locality. Piedra Arauicaua, Río Yatúa, alt. 120–200 m, Casiquiare, Territorio Amazonas, 3 Feb 1954, *Bassett Maguire, John J. Wurdack, & George S. Bunting 37465* (NY, holotype). Paratype. Piedra Tururumerí, alt. 110–220 m, Casiquiare, Territorio Amazonas, 4 Feb 1954, *Maguire, Wurdack, & Bunting 37513* (NY).

14. **Scleria stipularis** Nees, Jour. Bot. Hook. **2**: 394. 1840.

Hymenolytrum silvestre Schrad.; Nees in Mart., Fl. Bras. 2(1): 176. 1842. (*fide* Steud. Syn. Pl. Cyp. 171. 1855).

Scleria pyramidalis Hochst. ''Hbr. Hohenack. nr. 1171''; Steud., Syn. Pl. Cyp. 171. 1855. as synonym.

Type locality. British Guiana (*Schomburgk*).

Distribution. Forests, Guiana, Venezuela, and northern Brazil to Peru. VENEZUELA. Amazonas: Río Culebra, *Curran 268;* Cerro Huachamacari, Río Cunucunúma, *Maguire, Cowan & Wurdack 29959.* Bolívar: Alto Río Cuyuni, Río Uiri-yuk, *Maguire, Steyermark & Maguire 46958.* BRITISH GUIANA. *Schomburgk 913;* Upper Demerara River, *Jenman 4143.*

15. **Scleria ramosa** Clarke, Kew Bull. Add. Ser. **8**: 59. 1908.

Type locality. Goyaz: Brazil (*Burchell 8413*).

Distribution. Selvas, Venezuela and Brazil. VENEZUELA. Bolívar: Cerro Piton, Cordillera Epicara, Alto Río Cuyuni, Río Chicanán, *Maguire, Steyermark & Maguire 53647.*

16. Scleria macrogyne Clarke, Kew Bull. Add. Ser. **8**: 59. 1908.

Type locality. "British Guiana: *Parker, Appun 418;* Massaruni River, *Jenman 2643, 6088.* Brazil: Piauhy, *Gardner 2985;* Rio Negro; San Joaquin, *Ule 6065.*"

Distribution. In woods and thickets, British Guiana, Venezuela, and northern Brazil. VENEZUELA. Anzoategui: Bajos del Rio Cari, *Pittier 14855.* Bolívar: Headwaters of Río Chicanán, alt. 500 m, *Steyermark 89553.* BRITISH GUIANA. Mazaruni Station, *Forest. Dept. #F2526;* Kangaruma, Potaro River, *Maguire & Fanshawe 25002a;* Parabaru Savanna, between Rupununi and Kuyuwini Rivers, *Smith 3051;* Potaro River, Tumatumari, *Gleason 71;* East Coast Water Conservancy, Lamaha Stop-off, *Hitchcock 16877;* Malali, Demerara River, *De La Cruz 2690;* Pomeroon River, Pomeroon District, *De La Cruz 3035.*

17. Scleria cyperinoides Clarke, Kew Bull. Add. Ser. **8**: 61. 1908.

Type locality. "North Brazil, *Vaughan 28;* Rio Negro, Barra, *Spruce 1252;* South Brazil, *Burchell 9789.*"

Distribution. In dense forests, Venezuela to Brazil and Bolivia. VENEZUELA. Amazonas: Maroa, Guainía, Alto Rio Negro, *Williams 14203.*

18. Scleria camaratensis Core, sp. nov.

Culmo 1 m alto, triquetro, minute piloso; foliis 1 cm latis, subtus minute pilosa, supra glabrata; contra-ligula abbreviata; inflorescentia 14 cm longa, 2 cm lata; panicula 5 cm longa, pyramidale; spiculis masculis 3 mm longis, angustis; gluma foeminea naviculare, ovata, ferruginea, fere glabra; achaenio 2 mm longo, albo, globoso, laevissimo; hypogynio dentibus lineari-oblongis integris digitato. *Scleriae neogranatensis* proxime affinis.

Type locality. River bank in Camarata Valley, alt. 450 m, *G. G. Simpson 6,* 3 Mar 1939 (holotype VEN). Leandro Aristeguieta (in litt, 7 de agosto, 1963) states: "La localidad 'Camarata Valley' se encuentra al pie de la montana Auyantepui, Gran Sabana, Estado Bolivar, Venezuela."

This species resembles *S. neogranatensis* Clarke, which is known only from the department of Antioquia, Colombia. *S. camaratensis* has a much smaller panicle than that species and has a larger achene.

Distribution. River banks, southeastern Venezuela (known only from the type locality). Bolívar: Camarata Valley, alt. 450 m, *Simpson 6,* 3 Mar 1939 (type).

19. Scleria arundinacea Kunth, Enum. Pl. **2**: 347. 1837.

Scleria latifolia Nees, Flora **11**: 303. 1828; Boeck. Linnaea **38**: 530. 1874; not Sw.

Scleria sylvestris Poepp. & Kunth, Enum. Pl. 2: 346. 1837. "Provincia Peruviana Huanuco (in sylvis ad Cuchero). Poeppig legit."

Scleria cyanocarpa Kunth, Enum. Pl. 2: 347. 1837. "Brasilia meridionalis. Sellow legit."

Schizolepis latifolia Nees in Mart., Fl. Bras. 2(1): 186. 1842. Based on *Scleria latifolia* Sw.

Schizolepis trigonocarpa Nees in Mart., Fl. Bras. 2(1): 186. *pl. 26.* 1842. "In silvis prov. Maragnaniensis et Paraensis" (*Martius*).

Scleria silvestris Nees in Mart., Fl. Bras. 2(1): 188. 1842; variant spelling.

Schizolepis silvestris Nees in Mart., Fl. Bras. 2(1): 223–224 (index). 1842.
Scleria grandifolia Miq. Linnaea **19**: 230. 1847 (*fide* Boeck. Linnaea **38**: 532. 1847. "Crescit ad Osembo in Para" *Focke*).
Scleria kappleriana Hochst.; Steud. Syn. Pl. Cyp. 172, as syn. 1855.
Scleria trigonocarpa Steud. Syn. Pl. Cyp. 171. 1855. Based on *Schizolepis trigonocarpa* Nees.
Schizolepis arundinacea Palla, Denks. Acad. Wien **79**: 196. 1908. Based on *Scleria arundinacea* Kunth.
Scleria latifolia var. *arundinacea* (Kunth) Pfeiff. Rep. Spec. Nov. **52**: 171. 1943.

Type locality. "Nova Hollandia" in error; probably Martinique.

Distribution. Abundant in forests and clearings from Central America and the Lesser Antilles to Bolivia, Paraguay, and northern Argentina. VENEZUELA. Anzoategui: Along Río Leon by Quebrada Danta, alt. 500 m, *Steyermark 61018;* El Limón, alt. 1100 m, Puerto La Cruz, *Jahn 451.* Aragua: El Rancho Grande, *Moldenke & Moldenke 19554;* Rancho Grande, *Tamayo 721.* Bolívar: Las Delicias, Sta. Elena, Gran Sabana, alt. 900 m, *Tamayo 2777;* below Santa Teresita de Kavanayen, alt. 915–1065 m, *Steyermark 60539;* Sta. Elena, Gran Sabana, *Lasser 1312;* Cerro La Reforma, alt. 200–250 m, *Steyermark 88090;* Los Patos, alt. 363 m, *Steyermark 87009;* Río Cheulo, Carabobo, alt. 600 m, *Williams 10980;* between El Dorado and Cerro Uei, alt. 800–1000 m, *Steyermark & Nilsson 833;* Altiplanicie de Nuria, alt. 600–650 m, *Steyermark 88440, 89065;* Cerro Guaiquinima, Rio Paragua, *Maguire 33123;* Cerro Venamo, near British Guiana border, *Steyermark, Dunsterville & Dunsterville 92808;* Distrito Federal: Cerro Naiguatá, Lomas de Las Delicias, *Steyermark 92040.* Monagas: Cachipo, *Lasser & Vareschi 14027.* Sucre: Peninsula de Paria, *Steyermark & Agostini 91148.* BRITISH GUIANA. Aruka River, *Alston 448;* western extremity of Kanuku Mountains, Takutu River drainage, *Smith 3331;* Issorora, Aruka River, *Hitchcock 17552;* Malali, Demerara River, *De La Cruz 2650;* Kamakusa, Upper Mazaruni River, *De La Cruz 2791;* Pomeroon River, Pomeroon District, *De La Cruz 2904;* Waini River, Northwest District, *De La Cruz 3584.*

20. Scleria latifolia Sw. Prodr. Veg. Ind. Occ. 18. 1788.

Carex latifolia Gmel. Syst. Nat. 2: 138. 1791. Based on *S. latifolia* Sw.
Scleria nervosa Wikstr. Vet. Akad. Handl. **1827**: 75. 1827 (*fide* Clarke, Symb. Ant. 2: 152. 1900). Type locality, Guadeloupe.
Scleria loefgreniana Boeck. Vidensk. Meddel. **1894**: 240. 1895. Type locality, Fazenda Campo Grande, São Paulo, Brazil (*Edwall 1977*).
Scleria lacunosa Boeck. Allg. Bot. Zeitschr. 2: 160. 1896. Type locality, "India occident."

Type locality. Jamaica.

Distribution. Moist shady places, Central America and the Lesser Antilles, throughout tropical South America to southern Brazil and Bolivia. VENEZUELA. Merida: Tovar, *Fendler 1609.* Miranda: La Cortadera del Guayabo, *Badillo 674a.* BRITISH GUIANA. 23 miles Potaro Road, *For. Dept. F3086.*

21. Scleria acanthocarpa Boeck. Vidensk. Meddel. **1869**: 154. 1870.

Scleria glazioviana Boeck. Flora **65**: 352. 1882. "In vicinia urbis Rio de Janeiro leg. Glaziou; mis. sub. no. 13306."

Type locality. "In silvis ad Lagoa Santa m. Sept., Nov. lecta" (*Warming*).

Distribution. In woods, Colombia and Venezuela to Brazil. BRAZIL. Rio Branco: Between Vista Geral and Serra Sabang, *Maguire & Maguire 40296.*

22. Scleria bracteata Cav. Ic. **5**: 34. *pl. 457*. 1799.

Scleria floribunda HBK. Nov. Gen. & Sp. 1: 233. 1816 (*fide* Kunth, Enum. Pl. 2: 345. 1837.) ''Crescit locis temperatis, scopulosis regni. Novogranatensis inter Pandi et Fusagasuga, alt. 450–900 hex.''

Scleria papillata Willd.; Kunth, Enum. Pl. 2: 345, as syn. 1837. Type locality, Brazil.

Macrolomia bracteata Schrad.; Nees in Mart., Fl. Bras. 2(1): 182. *t. 24*. 1842. Based on *Scleria bracteata* Cav.

Scleria rigens Salzm.; Steud. Syn. Pl. Cyp. 171, as syn. 1855.

Scleria bracteata f. *simplicior* Kükenth in Fedde, Repert. Sp. Nov. 26: 253. 1929. Type locality, Tipuani, Bolivia (*Buchtein 5107*).

Scleria macrolomioides H. Pfeiffer in Fedde, Repert. Sp. Nov. 33: 214. 1933. Type locality, near ''Mindos,'' Mexico (herb. Liebm. ex herb. Univ. Christianiensis).

Scleria bracteata var. *floribunda* (HBK) Pfeiffer, Rev. Sudam. Bot. 5: 173. 1938 (''Venezuela'').

Scleria bracteata var. *supra-gynaecea* Pfeiffer, Rev. Sudam. Bot. 5: 174. 1938.

Type locality. ''Habitat inter Panamaidis mare et collem vulgo *Lancón*, in humidis saepiusque inundatis.''

Distribution. Common in moist thickets and borders of forests, Mexico and the West Indies throughout tropical South America to Paraguay and Bolivia. VENEZUELA. Anzoategui: Headwaters of Rio Leon, alt. 600–800 m, *Steyermark 61238*. Bolívar: Sta. Elena de Uairen, Gran Sabana, *Lasser 1537;* base of Mt. Roraima, alt. 1220–1980 m, *Steyermark 59032;* Guayapo, Bajo Caura, alt. 100 m, *Williams 11749;* below Santa Teresita de Kavanayen, alt. 915–1065 m, *Steyermark 60571;* near Mt. Roraima, *Steyermark 58647;* Río Caroní, *Cardona 2001;* Altiplanicie de Nuria, alt. 400 m, *Steyermark 88420;* SE of Hato de Nuria, alt. 400 m, *Steyermark 88810;* Ciudad Bolívar, *Bailey & Bailey 1925*. Distrito Federal: Losa, *Tamayo 528;* Carayaca, *Jahn 317;* near Caracas, *Pittier 9450;* Quebrada de San Lazaro, *Pittier 11064*. Merida: Prope coloniam Tovar, *Fendler 1608*. Miranda: Between Los Teques and El Carrizal, alt. 1000 m, *Pittier 13372;* near Agua Fria, *Pittier 11503;* near Guatire, *Ponte y Baez 4;* near Petare, *Pittier 11234;* Sebastopol, *Badillo 136;* around Los Teques, *Pittier 6031*. Monagas: Near Quiriquire, *Lasser & Vareschi 4156*. Nueva Esparta: El Valle, Margarita Island, *Viller & Johnston 187;* San Juan Mt., Margarita Island, *Johnston 203*. BRITISH GUIANA. *Schomburgk;* Waranama Ranch, Wiruni-Ituni Savannah, *Martyn 104;* Mt. Roraima, *Jenman 209;* ''Savannah,'' Camp River, *Jenman 1891*.

23. Scleria parallela Clarke, Kew Bull. Add. Ser. **8**: 59. 1908.

Type locality. ''Venezuela, Upper Orinoco near Esmeralda'' (*Spruce 3050*).

Distribution. Selvas, southern Venezuela, known only from the type locality. VENEZUELA. Amazonas: ''Upper Orinoco near Esmeralda,'' *Spruce 3050* (type).

24. Scleria muhlenbergii Steud. Nom. ed. 2. **2**: 543. 1841.

''*Scleria setacea*'' of Am. authors, not Poir. in Lam. Encyc. 7: 4. 1806.

Scleria reticularis Muhl. Descr. Gram. 266. 1817; not Michx. Fl. Bor. Am. 2: 167. 1803. ''Habitat in Carolina Septentrionali.''

Scleria micrantha Poir. in Lam. Encyc. Suppl. 5: 108. 1817. ''Cette plante a été recueillie par M. Ledru a Porto-Rico.''

Scleria reticularis Spreng. Syst. 3: 831, in part. 1826 (*fide* Boeck. Linnaea 38: 469. 1874).

Scleria reticularis J. & C. Presl; Presl, Rel. Haenk. 1: 202. 1828.

Scleria laxa Torrey, Ann. Lyc, N. Y. 3: 376. 1836; not R. Br. Prodr. 240. 1810.

Scleria oligantha A. Rich. in Sagra. Hist. Cuba 11: 295. 1850.

Scleria muhlenbergiana Liebm. Vidensk. Selsk. Skr. V. **2**: 258. 1850. Variant spelling for *Scleria muhlenbergii* Steud.
Scleria torreyana Walp. Ann. **3**: 696. 1852. "Habitat in America boreali (New Jersey, Long Island)."
Scleria hemitaphra Steud. Syn. Pl. Cyp. 169. 1855. Type locality, Louisiana (*Drummond*).
Scleria dictyocarpa Wright; Griseb. Cat. Pl. Cub. 249. 1866. "Cuba or. et occ., "*Wright 3416a.*"
Scleria bracteata var. *angusta* Griseb. Cat. Pl. Cub. 249, in part. 1866. Type locality, Cuba.
Scleria debilis Wright; Sauv. Anal. Acad. Cienc. Habana **8**: 154. 1871. "En sabanas húmedas de Pinar del Rio, Chirigota, Retiro, embarcadero de Bacunagua, &c."
Scleria reticularis var. *pubescens* Britton, Ann. N. Y. Acad. Sci. **3**: 232. 1885.
Scleria trichopoda Wright: Britton, Ann. N. Y. Acad. Sci. **3**: 232, as syn. 1885.
Scleria setacea var. *hemitaphra* Kükenth. in Fedde, Repert. Sp. Nov. **23**: 215. 1926. Based on *Scleria hemitaphra* Steud.
Scleria latilacunosa Kükenth. Bot. Jahrb. **56**: Beibl. **125**: 21. 1921. "Campo der Serra do Mel. Rio Branco, Surumu." *Ule 8065,* July 1909.

Type locality. "Am. septr."

Distribution. Abundant on pine barrens and low meadows, New York and Indiana to Florida and Texas; also in the West Indies, Central America and northern South America. VENEZUELA. Apure: San Juan de Rio Claro, *Borsotti 75.*

25. Scleria tenacissima Steud. Syn. Pl. Cyp. 175. 1855.

Omoscleria tenacissima Nees in Mart., Fl. Bras. 2(1): 181. 1842.

Type locality. "In silvis ad oppidum Barra do Rio Negro prov. ejusdem nominis et in graminosis udis silvaticis prov. Paraënsis" (*Martius,* type in BD).

Distribution. In woods, Venezuela and Brazil to Bolivia. VENEZUELA. Apure: Puerto Paez, *Velez 2214.*

26. Scleria lagoensis Boeck. Vidensk. Meddel. **1869**: 151. 1870.

Scleria moritziana Boeck. Linnaea 38: 460. 1874. "Caripe Venezuelae, *Moritz* hb. *n. 645b.*"

Type locality. "In paludibus et pratis humidis, nunc etiam in marginibus silvarum juxta campos circa Lagoa Santa frequens" (*Warming,* type in BD).

Distribution. Wet soil in campos and borders of forests, Colombia, Venezuela, Brazil, and Bolivia. VENEZUELA. Sucre: "Caripe Guanayuana," *Moritz* hb. n. *645b* (type of *S. moritziana* Boeck.). Collected in 1844, not seen in Venezuela since.

27. Scleria vaginata Steud. Syn. Pl. Cyp. 179. 1855.

Scleria tonduzii Boeck.; Tonduz, Bull. Herb. Boiss. **3**: 464, nomen. 1895; Allg. Bot. Zeitschr. **2**: 160. 1896. Type locality, Costa Rica. (*Tonduz 8181*).

Type locality. Not known ("Am. septr. an? austr.").

Distribution. In moist forests, Costa Rica to Colombia, Venezuela, Brazil, Peru and Bolivia. VENEZUELA. Aragua: Parque Nacional Henry Pittier, *Steyermark 89834.*

28. Scleria flagellum-nigrorum Bergius, Vet. Akad. Handl. Stockh. **26**: 144. *pl. 4.* 1765.

Scleria flagellum Sw. Prodr. Veg. Ind. Occ. 18. 1788; Fl. Ind. Occ. **1**: 88. *pl. 3.* 1797. Type locality, Jamaica.
Scleria margaritifera Gaertn. Fruct. **1**: 13. *pl. 2.* 1788 (*fide* Sw. Fl. Ind. Occ. 88. 1797).

Carex flagellum Gmel. Syst. Nat. **2**: 138. 1791. Based on *Scleria flagellum* Sw.
Scleria glabellum Poir. in Lam. Encyc. **7**: 1, sphalm. 1806.
Scleria nigricans J. & C. Presl; Presl, Rel. Haenk. **1**: 201. 1828. "Hab. ad Guayaquil," Ecuador (*Haenke*).
Omoscleria flagellum Nees in Mart., Fl. Bras. **2**(1): 180. 1842. Based on *Scleria flagellum* Sw.
Scleria flagellum var. *angustifolium* Nees; Boeck. Linnaea **38**: 504. 1874.

Type locality. "Habitat in Surinamo & Jamaica, in sylvis, inter vepres & arbores quibus fulcitur" (type in S.).

Distribution. In woods and thickets, British Guiana, Venezuela, Brazil and Ecuador. VENEZUELA. Delta Amacuro: Lower Orinoco, *Rusby & Squires 91*. Guarico: Carretera Calabozo-Camaguan, *Ramia 1294*. Both these collections resemble somewhat the type specimen of this species but are too young for positive identification. BRITISH GUIANA. Kamakusa, *Leng 324;* Kuyaliwak Falls, Basin of Essequibo River, *Smith 2151*.

29. Scleria melaleuca Reichb.; Schlect. & Cham. Linnaea **6**: 29. 1831.

Scleria communis Liebm. Vidensk. Selsk. Skr. V. 2: 71, in part. 1850. (*fide* Clarke, Symb. Ant. 2: 146. 1900).
Scleria pratensis var. *melanocarpa* Boeck. Vidensk. Meddel. **1869**: 153. 1870. "Ad Lagoa Santa cum forma typica."
Scleria pratensis var. *mucronata* Boeck. ms. (*fide* Clarke, Symb. Ant. 2: 146. 1900).
Scleria pterota var. *melaleuca* (Reichb.) Standley, Field Mus. Pub. Bot. **18**: 106. 1937.

Type locality. Hacienda de la Laguna, Surinam (*Weigelt*).

Distribution. Common in wet grassy plains and on banks along shaded streams, West Indies and Mexico through Central America to Colombia, Venezuela, Guiana, Brazil, Peru, and Bolivia. VENEZUELA. Amazonas: Maroa, Guiania, Alto Rio Negro, *Williams 14248*. Barinas: Near Barinas, *Angulo* in December, 1939. Bolívar: Caruco de Guayapo, *Williams 12061;* Guayapo, Bajo Caura, *Williams*, 3 Mar 1939. Delta Amacuro: *Rusby & Squires 335;* Caño del Corisal, *Bond, Gillin & Brown 200*. Miranda: Parque Nacional de Guatopo, *Steyermark 90017*. Monagas: Near Quiriquire, *Lasser & Vareschi 4164*. Sucre: Lago de Guanoco, *Vareschi & Lasser 3954;* Cristobal Colon, *Broadway 390;* Cariaquita, Paria Peninsula, *Bond, Gillin & Brown 4*. BRITISH GUIANA. *Schomburgk; Jenman 404;* Pl. Vryheid, *Linder 70;* Junction of Mazaruni and Cuyuni Rivers, *Graham 158;* Georgetown, vicinity of Peter's Hall, *Hitchcock 16674;* Between the Demerara and Berbice Rivers, *De La Cruz 1636;* "Coast region," *Jenman 4366*.

30. Scleria pterota Presl, Isis **21**: 268. 1826.

Schoenus latifolius Vahl, Enum. 2: 226. 1806 (*fide* Kunth, Pl. 2: 38. 1837).
Scleria latifolia Sieber; Presl, Isis **21**: 268. 1828 (*fide* Boeck. Linnaea **38**: 482. 1874).
Scleria asperata Presl, Isis **21**: 268. 1828.
Scleria margaritifera Presl, Isis **21**: 268. 1828 (*fide* Boeck. Linnaea **38**: 482. 1874).
Dichromena vahlii Dietr. Sp. Pl. 2: 169. 1833 (*fide* Clarke, Symb. Ant. 2: 147. 1900).
Scleria affinis Presl; Steud. Nomencl. ed. 2. **2**: 542. 1841.
Scleria communis Kunth, Enum. Pl. 2: 340, pro parva parte. 1837 (*fide* Clarke, Symb. Ant. 2: 146. 1900). "Brasilia, Bahia, Martinica, Jamaica, et ?Nova Hollandia (an patria a Sieb. recte notata?).
Scleria selloana Schrad.; Nees in Mart., Fl. Bras. **2**(1): 179 as syn. 1842.
Scleria conspersa Sellow; Nees in Mart., Fl. Bras. **2**(1): 179. 1842.
Scleria pratensis Lindl.; Nees, Nova Acta Acad. Leop. Carol. **19**: Suppl. 1: 121. 1843.
Scleria simplicior Steud. Syn. Pl. Cyp. 169. 1855. "Rengger legit in Paraguay."
Scleria ottonis Boeck. Linnaea **38**: 490. 1874. Type locality, Cuba (*Otto 299*).

Scleria flagellata Sw.; Boeck. Linnaea **38**: 506, as syn. 1874.
Scleria pittieri Boeck.; Tonduz, Bull. Herb. Boiss. **3**: 7, nomen. 1895. Allg. Bot. Zeitschr. **2**: 159. 1896. "In Costarica leg. H. Pittier."
Scleria boliviana Palla; Buchtein, Contrib. Fl. Boliv. **1**: 90. name only. 1910.

Type locality. Puerto Rico.

Distribution. Common in boggy meadows and wet clearings throughout the West Indies, southern Mexico, Central America, Colombia, Venezuela, Guiana, Brazil, Bolivia, Paraguay, and northern Argentina. VENEZUELA. Amazonas: Puerto Ayacucho, *Foldats 3596.* Anzoatequi: Pariagnan, *Hernandez 35.* Bolívar: La Entrada, Carabobo, alt. 600 m, *Williams 10983;* Los Patos, alt. 363 m, *Steyermark 86999;* junction of Río Paramichi with Río Paragua, alt. 510–525 m, *Steyermark 90561;* Mt. St. Ana, Paraguana, *Curran & Haman 709.* Cojedes: San Carlos, *Rudd 453.* Delta Amacure: *Gines 4859, 5242.* Falcon: Las Mercedes, *Lasser & Foldats 3116.* Lara: Sabanas de Cujicito, alt. 300–450 m, *Saer 551.* Zulia: Sabanas de Machiques, *Lasser 2524.* BRITISH GUIANA. East Coast, Demerara, *Harrison 884.*

31. Scleria secans (Linnaeus) Urban, Symb. Ant. **2**: 169. 1900.

Schoenus secans L. Syst. ed. 2. 865, excl. syn. Rumpf. 1759.
Carex lithosperma L. Syst. ed. 12. 618, in part. 1767 (*fide* Sw. Fl. Occ. **1**: 88. 1797).
Schoenus lithospermus L. Sp. Pl. ed. 2. **1**: 65, in part. 1762 (*fide* Sw. Ind. Fl. Occ. **1**: 88. 1797).
Scleria scabra Willd. Sp. Pl. **4**: 315. 1805. Cumana, Venezuela (*Humboldt*).
Arundo farcta Aubl. Pl. Guian. **1**: 52. 1775 (*fide* Poir. in Lam. Encyc. **7**: 1. 1806).
Scleria reflexa HBK. Nov. Gen. & Sp. **1**: 232. 1816. "Crescit locis planis humidis Novae Andalusiae prope Cumana et Bordones."
Scleria caricifolia Schrad.; Nees in Mart., Fl. Bras. **2**(1): 177, as syn. 1842.
Mastigoscleria reflexa Nees in Mart., Fl. Bras. **2**(1): 177. 1842. Based on *Scleria reflexa* HBK.
Scleria renggeriana Steud. Syn. Pl. Cyp. 173. 1855. Type locality, Paraguay.
Scleria weigeltiana Schrad.; Boeck. Linnaea **38**: 504, as syn. 1874.
Scleria porphyrorhiza Wright; Sauv. Anal. Acad. Cienc. Habana **8**: 155. 1871. "En los pinares de la Vuelta de Abajo, cerca de Pinar del Rio." *Wright.*
Scleria lobulata Palla, Denks. Akad. Wien **79**: 197. 1908. Type locality, Campinas, Brazil, *Campos Novaes 1324.*

Type locality. Jamaica. (Type in BM).

Distribution. Common in wet thickets and savannas, West Indies and Mexico through Central America, Colombia, Venezuela, Guiana, Brazil, Ecuador, Peru and Bolivia to Paraguay. VENEZUELA. Amazonas: Sanariapo, *Williams 13070, 16063;* Playa Alta, Río Orinoco, *Maguire, Cowan & Wurdack 29346;* Cerro Sipapo (Paraque), *Maguire & Politi 29063;* Culebra Savanna, Río Cunucunuma, Río Orinoco, *Maguire, Cowan & Wurdack 30427;* Isla de la Raton, Alto Orínoco, *Williams 13217.* Anzoategui: Bajos del Río Carí, *Pittier 14861.* Aragua: El Rancho Grande, *Moldenke & Moldenke 19555.* Bolívar: Guayapo, Bajo Caura, *Williams 11853;* S of Roraima, Gran Sabana, *Steyermark 59060;* Río Caroní, Guayana, *Cardona 1616;* Cerro La Danta, alt. 1040–1060 m, *Steyermark & Nilsson 47;* Altiplanicie de Nuria, alt. 400 m, *Steyermark 88461;* Quebrada O-paru-ma, between Santa Teresita de Kavanayén and Río Pacaireo, *Steyermark 60433;* Río Venamo, Cerro Venamo, near British Guiana border, *Steyermark, Dunsterville & Dunsterville 92692.* Distrito Federal: Along cascades of Quebrada Vasenilla in vicinity of La Escalera, *Steyermark 92062;* Cerro Naiguatá, Lomas de Las Delicias, *Steyermark 92133.* Delta Amacuro: Santa Catalina, *Rusby & Squires 329;* Burojoiola, *Gines 4859.* Falcon: Cerro de Sta. Ana, Paraguana, *Tamayo 788.* Sucre: Cumana, *Humboldt.* BRITISH GUIANA. Tumatumari, *Gleason 120;* Bartica, *Hitchcock 17256;* Junction of Mazaruni and Cuyuni Rivers, *Graham 280;* Orinduik, Ireng River, *Harrison 1374;* Matthews Ridge, Barima River, Northwest Territory, *Maguire 40498.* BRAZIL. Rio Branco: savannas, SE of Serra Sabang, *Maguire & Maguire 40284.*

RAPATEACEAE [23]

In 1958 most of the genera of the Rapateaceae [24] were reviewed by me. Only *Stegolepis* and *Rapatea* were not then treated. Here now these two genera may be fitted into the synopsis of 1958 in the places indicated in presentation of formal hierarchy and position in the key. Further consideration is given to the genus *Epidryos.*

In my view *Stegolepis* stands, along with *Kunhardtia,* closest to *Saxofridericia,* which itself seems to have retained a totality of character that may be nearest to a presumptive archetype in the Rapateaceae. *Stegolepis* differs from *Saxofridericia* primarily in the loss of enveloping cephalar bracts. *Stegolepis* shows much more flexibility and variation of form than does its more conservative congener. It shows a marked trend in reduction from a many (100 or more)-flowered inflorescence to one of but a single flower, and in the proliferation of inflorescences from a single massive one to more numerous sometimes filiform peduncles. This genus seems to have been evolutionarily the family's most successful, if number of species produced is a measure.

On the other hand *Rapatea,* the second largest and apparently the second most successful genus, seems to stand as the ultimate in present evolutionary modification of reproductive organs. The primitive cephalar bracts have been retained, but gynoecial simplification has been achieved by the regular abortion of two of the unitary ovules, often accompanied by the collapse of the external wall of the two affected carpels, so as to make the ovary functionally one-celled and productive of but a single seed.

Neither genus is static; both present strong indications of active genetic mobility and vigor. *Stegolepis* is confined to the sandstone region of Guayana; *Rapatea* has a widespread distribution.

Stegolepis Klotzsch ex Körnicke, Linnaea **37**: 480. 1872.

Peduncles several, axillary; inflorescence lacking subtending spathaceous bracts (except in subsect. *Gleasoniana*) which are represented by vestigial narrow membranous scales or "flaps"; bracteoles gradate (except in subsect. *Gleasoniana*); sepals membranous at base, most often connate into a short tube, the limb indurate, exserted, reflexed in the *Pauciflora;* petals differentiated into claw and limb, the claw most often connate into a short tube, the limb various in form; stamens 6; filaments free or usually connate at the base, the tube discrete or adnate to the corolla tube; anthers 4-locular, dehiscing subterminally by a single or double pore, caudate at the base, the posterior lobes prolonged, somewhat cucullate; pollen grains oval-oblong, with a single narrowly elliptic sulcus, exine scrobiculous; ovary 3-locular, loculicidal; locules pluriovulate; placentation axial; seed prismatic or more or less pyramidal, testa (in sicco) alveolate or somewhat striate, usually pale.

Herbaceous perennials with a short or commonly elongate unbranched or paucicipital caudex bearing equitant conduplicate leaf-sheaths, often producing a broad flattened aspect; blades linear-lanceolate, ensiform or gramineous.

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[23] Pollen descriptions prepared by Dr. Shoichi Kawano.

[24] Maguire, Bassett, Mem. N. Y. Bot. Gard. 10(1): 19–49. 1958.

Plants of open marshy places and wet cliff faces, less often in open woodland; confined to middle and upper altitudes of the sandstone regions of the Guayana Highland.

Type. *Stegolepis guianensis* Klotzsch ex Körnicke.

The genus *Stegolepis* has differentiated into three fairly distinct natural sections, viz., *Guianensis, Pungens* and *Pauciflora.*

The more primitive sect. *Guianensis,* of which *S. grandis* of western Guayana stands first, has in general many-flowered (usually more than 60) sphaeroidal heads with little evidence of lateral compression. Two more closely interrelated groupings within the section: subsect. *Guianensis* of four species, with broadly ovate or obovate, flabellate petals, and the subsect. *Ferruginea* also of four species, are held together by similar habit, general appearances, and by lanceolate relatively thickened petals.

Section *Pungens,* of five species, is characterized by laterally compressed heads of several to numerous (under 50) spikelets, in which the sepals in anthesis are not reflexed. Two closely related species, *S. ptaritepuiensis* of eastern Guayana and *S. neblinensis* of western Guayana, may be better placed in the next section.

In the assemblage, sect. *Pauciflora,* which is apparently the most advanced, in the sense of reduction of spikelet (hence flower) number to 1-several, the few spikelets and reflexed sepals satisfactorily hold the member species together. The subordinate groupings are manifest.

Subsect. *Pauciflora,* with eight recognized species, is made up of a series of four interrelated species of close morphologic and geographic association. The remaining four, *wurdackii, ligulata, linearis* and *cardonae,* are individually strongly discrete in form, technical characters and geography.

The remaining two species are placed in the subsect. *Gleasoniana* because of the anomalous development of subtending, narrowly linear-lanceolate cephalar bracts, and reversely gradate fewer bracteoles, of which the inner are shorter and the outer longer; the reverse of the condition generally obtaining in the genus.

It is interesting to note that only on Cerro Duida in western Guayana are representatives of all sections found.

Hierarchal Arrangement of the Species of *Stegolepis*

- Sect. *Guianensis*
  - Subsect. *Guianensis*
    1. *S. grandis* Maguire
    2. *S. guianensis* Kl. ex Körn.
    3. *S. angustata* Gleason
    4. *S. vivipara* Maguire
  - Subsect. *Ferruginea*
    5. *S. parvipetala* Steyermark
    6. *S. choripetala* Maguire
    7. *S. steyermarkii* Maguire
    8. *S. ferruginea* Baker
- Sect. *Pungens*
  9. *S. pungens* Gleason
  10. *S. squarrosa* Maguire
  11. *S. neblinensis* Maguire
  12. *S. ptaritepuiensis* Steyermark
  13. *S. celiae* Maguire
- Sect. *Pauciflora*
  - Subsect. *Pauciflora*
    14. *S. pauciflora* Gleason
    15. *S. hitchcockii* Maguire
    16. *S. pulchella* Maguire
    17. *S. membranacea* Maguire
    18. *S. wurdackii* Maguire
    19. *S. ligulata* Maguire
    20. *S. linearis* Gleason
    21. *S. cardonae* Maguire
  - Subsect. *Gleasoniana*
    22. *S. gleasoniana* Steyermark
    23. *S. perligulata* Maguire

Key to the Species of *Stegolepis*

1. Inflorescence essentially globose, little compressed; indurated blades of sepals not reflexed at maturity (section *Guianensis*).

2. Spikelets of the inflorescences numerous, normally exceeding 70; leaf-sheaths indurated, nerveless.

3. Peduncles compressed and dilated at the summit to 2.5 cm broad; heads 5 cm or more in diam, spikelets about 100, ca. 20 cm long; inner bracteoles ca. 5 × 10 mm, nerveless; plants of Amazonas, western Guayana. 1. *S. grandis.*

3. Peduncles triquetrous at the summit; plants of eastern Guayana.

4. Heads 4.0–4.5 cm diam, spikelets usually 80–100, 16–18 mm long; bracteoles 12–14, the inner ca. 3 × 15 mm; petals 16–18 mm long, the blade delicate, more or less orbicular. 2. *S. guianensis.*

4. Heads 2.5–4.0 cm diam; spikelets 70–100, 10–16 mm long; petals ovate-lanceolate to lanceolate, subcarnose. 5. *S. parvipetala.*

2. Spikelets of the inflorescences comparatively few, normally fewer than 50.

5. Mature leaf-sheaths indurated, nerveless; petals lanceolate. 6. *S. choripetala.*

5. Mature leaf-sheaths papyriferous or submembranous, or if somewhat indurated then more or less conspicuously nerved.

6. Leaf-sheaths papyriferous or submembranous, gradually narrowed toward the summit; caudex more or less rounded in cross-section; petals obovate.

7. Leaf-sheaths becoming marcescent and fibrous; spikelets ca. 20 mm long; bracteoles 24–26, ca. 3.5 × 14 mm; petals broadly obcordate; filaments puberulent 3. *S. angustata.*

7. Leaf-sheaths papyriferous, becoming marcescent but not fibrous, leaf-blades 1.5–2.5 cm broad; spikelets broadly oblong-conic 5–6 mm diam, ovary often replaced by bulbils. 4. *S. vivipara.*

6. Leaf-sheaths more or less abruptly expanded and rounded at the summit, subindurate, conspicuously nerved, broadly scarious-margined; spikelets fusiform-conic; petals lanceolate.

8. Leaf-sheaths broadly rounded, 5–7 × 14–16 cm; mature leaf-blades 3.5–4.5 cm broad, the apex frequently abruptly oblique, short acuminate; petals lanceolate, obscurely puberulent externally. 7. *S. ferruginea.*

8. Leaf-sheaths narrowly rounded, 3.5–4.5 × 18–20 cm; mature leaf-blade 1.5–3.0(3.5) cm broad, the apex long subfalcately acuminate; petals lanceolate, glabrous. 8. *S. steyermarkii.*

1. Inflorescence compressed, not globose; summit of peduncle compressed and dilated but not at all or little triquetrous.

9. Spikelets 5–50 (in *S. ptaritepuiensis* var. *acuminata* and *S. neblinensis* 1–5); indurated blade of sepals not reflexed at maturity (section *Pungens*).

10. Spikelets 2.3–3.8 cm long, inclusive of unopened sepals.

11. Spikelets usually 10–30, bractlets, at least the upper, recurved or squarrose; leaf-sheaths and blades massive, the sheaths exceeding 8 cm and the blades 5 cm in width.

12. Spikelets 30–38 mm long, inclusive of unopened sepals; bractlets pungently acute, recurved but the tip neither squarrose nor deciduous; petals ca. 30 mm long, the blade obcordate very fleshy; filaments united into a tube 6–7 mm long; leaf-blades coriaceous, 6–7 cm broad. 9. *S. pungens.*

12. Spikelets 25–28 cm long, inclusive of unopened sepals; bractlets finely acuminate, strongly squarrose, the tip soon deciduous; petals ca. 30 mm long, the blade obcordate relatively fragile; leaf-blades coriaceous, 5–8 cm broad. 10. *S. squarrosa.*

11. Spikelets 1–3, bractlets not at all squarrose; leaf-sheaths 3–4 × 8–10 cm, blades 1.5–2.5 cm broad. 11. *S. neblinensis.*

10. Spikelets 1.2–2.2 cm long, inclusive of unopened sepals.

13. Spikelets (1)–5–20, 18–22 mm long, inclusive of unopened sepals; petals ca. 20 mm long, the blade obcordate not fleshy; filaments free to the base; leaf-blades coriaceous, 2.0–2.5 cm broad. 12. *S. ptaritepuiensis.*

13. Spikelets 20–50, 12–16 mm long, inclusive of unopened sepals; leaf-blades coriaceous, 5–9 cm broad. 13. *S. celiae.*

9. Spikelets 1–4, seldom 5; indurated blade of sepals reflexed at anthesis, soon deciduous (section *Pauciflora*).

14. Inflorescence ebracteate, or the subtending bracts scale-like; inner bracteoles of the spikelets exceeding the outer.
  15. Auricles of leaf-sheath prominent.
    16. Auricles rounded but not ligulate.
      17. Midrib leaf-blade coriaceous, and secondary veins not prominent.
        18. Spikelets, inclusive of unopened sepals, 2.5–3.0 cm long. 14. *S. pauciflora.*
        18. Spikelets, inclusive of unopened sepals, 2.0 cm or less long. 15. *S. hitchcockii.*
      17. Midrib leaf-blade firmly chartaceous, and secondary veins both prominent.
        19. Peduncles relatively coarse, 1–2 mm broad.
          20. Auricles of leaf-sheaths broadly and delicately scarious-margined; sheaths indurated, nerveless; secondary veins of blades prominulous. 16. *S. pulchella.*
          20. Auricles of leaf-sheaths not so margined, sheaths papyriferous, evidently nerved; secondary veins of blades prominent. 17. *S. membranacea.*
        19. Peduncles subfiliform, 0.5–0.8 mm broad. 18. *S. wurdackii.*
    16. Auricles ligulate, the ligule lanceolate, 3–4 cm long; blades linear, 1 cm or less broad. 19. *S. ligulata.*
  15. Auricles of leaf-sheath lacking.
    21. Leaf-blades linear, 1 cm or less broad; spikelets ovate-conic 10–12 mm long. 20. *S. linearis.*
    21. Leaf-blades lanceolate, 2–3 cm broad; spikelets conic-fusiform, 15–20 mm long. 21. *S. cardonae.*
14. Inflorescence bibracteate (subsection *Gleasoniana*).
  22. Cephalar bracts 14–18 mm long; flowers 1–4; auricles lacking. 22. *S. gleasoniana.*
  22. Cephalar bracts 25–28 mm long; flowers 1; auricles of the leaf-sheath very prominent, ligulate, 3–4(–6) cm long. 23. *S. perligulata.*

I. **Stegolepis** sect. **Guianensis** Maguire, sect. nov.

Capitulae multiflorae, sphaericalae, non-compressae.

IA. **Stegolepis** sect. **Guianensis** subsect. **Guianensis** Maguire, subsect. nov.

Petalae late obovatae vel obcordatae.

1. **Stegolepis grandis** Maguire, sp. nov.

Herbae perennes ad 3 m altae; vaginis induratis, non-marginatis, enervatis; vaginis (15–)40–50 cm longis, 5–9 cm latis conduplicatis, lanceolatis, subinduratis; ligulis ca. 4 mm longis; laminis linearibus (0.5–)1.5–2.5 m longis, 4–8 cm latis, subtus minute punctatis, venis primariis ca. 1 mm apartis, apice acuminato-falcato; pedunculo solitario, ingente, sursum valde crasso et compresso-dilatato, ad 2.5 cm lato; bracteis cephalaribus deficientibus; capitulis globosis 4.5–5.5 cm diam; spiculis plus minusve 100, ca. 2 cm longis; bracteolis numerosis 25–40, gradatis, induratis; sepalis lanceolatis induratis, ad basim membraneis; petalis ca. 25 mm longis, unguibus ad basim 10–12 mm in tubo connatis; filamentis glabris, antheris lineari-lanceolatis, 4-locularibus, loculis posterioribus apice 1 mm obtusis productis; ovario triloculare, loculis pluriovulatis; stylis subulato-trigonis sursum acute trigonalibus; capsulis induratis; seminibus 3.0–3.5 mm longis, 1.7–2.0 mm crassis, facie exteriore convexa, facie interiore 3–4 plano-concava, testa pallida, valde (in sicco) alveolata.

1a. **Stegolepis grandis** Maguire subsp. **grandis.**

Foliis 2–3 m longis; vaginis 40–50 cm longis; spiculis ca. 100, fusiformibus 18–20 mm longis; bracteolis 30–34, valde gradatis, exterioribus 4–8 mm longis, 3–6 mm latis, ovato-oblongis, valde obtusis; interioribus lanceolati-oblongis, acutiusculis, 10–12 mm longis, 3–4 mm latis; petalis ca. 25 mm longis, laminis obcordatis 10–12 mm longis, apiculatis; seminibus enormiter pyramidalibus 2.5–3.5 mm diam.

Type. Vigorous plants 3 m high, frequent, at alt. 1800 m, Cerro Huachamacari, Rio Cunucunuma, Terr. Amazonas, Venezuela, 6 Dec 1950, *Bassett Maguire, Richard S. Cowan, John J. Wurdack 30023* (holotype NY). Paratype. Cerro Huachamacari at alt. 1850 m, 17 Dec 1950, *Maguire, Cowan & Wurdack 30296;* 14 Dec 1950, *Maguire, Cowan & Wurdack 30246.*

Distribution. Known only from the type locality, the summit of Cerro Huachamacari, and questionably from the adjacent Cerro Duida by the unicate post-mature specimen, *Tate 399* (NY), and a single leaf, *Steyermark 58339* (F).

1b. Stegolepis grandis Maguire subsp. **phelpsiae** Maguire, subsp. nov.

Foliis 1–2 m longis; vaginis 25–30 cm longis; bracteolis ca. 40 valde gradatis, exterioribus oblongo-ovatis ca. 3 mm longis, obtusis, 1-nervis, anguste scarioso-marginatis; interioribus oblanceolatis ca. 14–15 mm longis, brevi-acuminatis, subacutis, 5-nervis; petalis ca. 25 mm longis, laminis spathulato-obovatis, apiculatis.

Type. Caudex to 0.3 m high, scape one, flowers yellow, gelatin copious at base of leaf, frequent in cumbre at alt. 2000 m, Serranía Parú, Río Parú, Río Ventuari, Amazonas, Venezuela, 31 Jan 1951, *Richard S. Cowan & John J. Wurdack 31114* (holotype NY). Paratypes. Serranía Parú: Very common, open areas, summit at alt. 1500 m, 3 Feb 1949, *K. D. Phelps & C. B. Hitchcock 533* (NY); sabanita and scrub forest at alt. 2000 m, 2 Feb 1951, *Cowan & Wurdack 31192.*

Distribution. Known only from the type locality, but there abundant.

2. Stegolepis guianensis Klotzsch ex Körnicke, Linnaea **37**: 481. 1872.

Type. Prope fluvium Roraima. *Rich. Schomburgk 672/ 987B* (holotype B, isotypes G, K, NY).

Distribution. Moist open places at middle elevations on sand overlying sandstone, region of Mount Roraima, British Guiana, and Venezuela. VENEZUELA. Estado Bolívar, Gran Sabana: Mt. Roraima, 20 Dec 1884, *Jenman 338* (US); flowers and bracts orange, Glycon Swamp, southwest-facing slopes, alt. 1830–1920 m, 25 Sep 1944, *Steyermark 58644* (F, VEN, US); common and apparently only type on summit, Great Central Rift, Central Swamp, at southern end, alt. 2700–2740 m, 28 Sep 1944, *Steyermark 58918* (F, NY, US); on southwest-facing sandstone ledge, alt. 2100–2620 m, 28 Sep 1944, *Steyemark 58932* (F, VEN); Serra do Sol, *Maguire & Maguire 40423;* Ilu-tepuí, *Maguire 33406.* BRITISH GUIANA. Parkaraima Mountains: Samwarakna-tipu, Kamarang River, Wenamu Trail, 9 Nov 1951, *Maguire & Fanshawe 32496;* Mt. Ebini, Mahdia River, 15 Oct 1951, *Maguire 32128.*

3. Stegolepis angustata Gleason, Bull. Torrey Club **56**: 18. 1929.

Type. Kaieteur Savanna, British Guiana, Sept–Oct 1881, *Jenman 958* (holotype K).

Distribution. Kaieteur and Pakaraima Savannas, British Guiana, Gran Sabana, Estado Bolívar, Venezuela. BRITISH GUIANA. Kaieteur Plateau: 1908, *Linnell sine no.* (NY); perennial herb, leaves "fan-shaped," brown, flower heads

10–20-rayed, flowers yellow, 2–4 peduncles per leaf-sheath, frequent in boggy places, border of bush islands, 6 May 1944, *Maguire & Fanshawe 23261* (NY, GH, K, US, U); bracts pale yellow, petals large, brilliant golden-yellow, on open sandy ground sometimes with *Brocchinia reducta,* ca. alt. 1200 ft, 4 Sep 1937, *Sandwith 1349* (NY). Imbaimadai Savannas, Upper Mazaruni River, alt. 550 m: perennial herb, base fibrous, little compressed, leaves 1 m long, scapes usually 3 per leaf, heads spherical, locally common in boggy savannas, *Maguire & Fanshawe 32199* (NY, K); herb with rounded little compressed densely fibrous bases, heads pale yellow, globose, Samwarakna Savanna, alt. 560 m, 11 Oct 1951, *Maguire & Fanshawe 32495* (NY, US); perennial herb, base densely fibrous, almost round, flowers pale yellow, spikes fusiform, wet savanna, alt. 550 m, 24 Oct 1951, *Maguire & Fanshawe 32253.* VENEZUELA. Estado Bolívar: flores amarillas lugares pantanosos entre el Cerro Perai y las fuentes del Rio Uaiparú, afluente del Ikabaru, alt. 900 m, Caroní, Guayana, 22 Oct 1946, *F. Cardona 1874* (VEN, US); planta macolluda de hojas imbracadas en la base y flores amarillas trimeras; sabanas, Kavanayén, Guayana, alt. 1300 m, 27 Mayo 1946, *T. Lasser 1727* (US); Gran Savana bordering forest near Rio Karuai, northwest Santa Teresita, alt. 1220 m, 26 Oct 1944, *Steyermark 59405* (VEN, F, US); Gran Sabana, morichal cercito al conuco de Odreman, Sta. Elena, Marzo 1946, *F. Tomayo 3065* (US); perennial herb 10–15 dm high, flowers yellow, occasional border thickets, Gran Sabana, Kamarang headwaters, alt. 1000 m, 6 Mar 1952, *Maguire 33304* (VEN, NY, F).

4. **Stegolepis vivipara** Maguire, sp. nov.

Herbae perennes ad 1 m altae; vaginis conduplicatis chartaceis vel submembranaceis, nervatis, oblongo-lanceolatis, 12–18 cm longis, 2.5–3.5 cm latis, exauriculatis, anguste scario-marginatis; laminis lineari-lanceolatis, 30–70 cm longis, 1.5–2.5 cm latis, costa prominenta, venis prominulis 0.6–1.0 mm apartis, apice acutis vix falcatis; pedunculis 1–2 per axillis, 6–12 dm longis, 3–4 mm diam, valde nervatis, prophyllis membranaceis, profunde bifidis, 10–15 cm longis conduplicatis, ca. 1.5 cm latis; inflorescentiis subsphaeroideis, 2.5–3.0 cm diam, vulgo 25–35-floribus, vulgo conspicue viviparis, bulbulis ad 10 cm longis; spiculis late ovato-oblongis, ca. 1.5 cm longis; sepalis inclusis, ca. 6 mm diam; bracteolis ca. 16, orbicularibus vel orbiculari-ovatis, concavis, ad basim membranaceis, 1–3-nervis, exterioribus ca. 3 mm longis interioribus ca. 7 mm longis; sepalis 3, unguibus scariosis, laminis induratis, oblongis, ca. 10–12 mm longis, acutiusculis; petalis 3, obovatis, apiculatis, 14–15 mm latis, 22–24 mm longis, unguibus ca. 1.5 mm connatis, 7-nervis; staminibus 6, filamentis ca. 7 mm longis, scariosis compressis ca. 0.6 mm latis, ad basim dilatis, in cylindro 1.5–2.0 mm alto connatis; antheris corrugatis lineari-lanceolatis, sagittatis, 8–10 mm longis, 4-locularibus, loculis posterioribus apice 1 mm productis; ovario 3-loculare, loculis pluriovulatis; stylo subulato-trigono, ca. 12 mm longo, sursum acute trigonale, stigma terminale; capsulis late oblongis, ca. 8 mm longis, 4–5 mm diam, crasse induratis, lacuna prominenta; seminibus mihi ignotis.

Type. Leaves appearing whorled, scapes 1–2, flowers yellow, viviparous, frequent in thickets along river bank, lower cumbre at alt. 1860 m, Chimantá-tepuí, Estado Bolívar, Venezuela, 2 Feb 1955, *Julian A. Steyermark & John J. Wurdack 332* (holotype NY, isotypes VEN, US, F).

Distribution. This interesting species is known only by the type collection from Chimantá-tepuí of the Gran Sabana of Venezuela.

Stegolepis vivipara is unique in the family by its production of bulbules which seem completely to replace the ovary. These bulbules are evidently reproductive. Seed apparently do not occur in mature capsules. Its nearest relative is clearly *S. angustata*, having similar inflorescences and submembranous veining leaf-sheaths, but lacking fibrous marcescent old sheaths.

IB. Stegolepis sect. **Guianensis** subsect. **Ferruginea** Maguire, subsect. nov.

Petalae anguste lanceolatae vel ovato-lanceolatae.

5. Stegolepis parvipetala Steyermark, Fieldiana Bot. **28**: 133. 1951.

Key to the Subspecies of *Stegolepis parvipetala*

1. Spikelets commonly 60 or less, 14–15 mm long; bracteoles 22–26, 3–10 mm long; blade of petals lanceolate, exauriculate, claws united in a tube 4–5 mm long; sepals 14–15 mm long, united in a tube 4–5 mm long. subsp. *parvipetala*.
1. Spikelets commonly 60–100 or more, 10–12 mm long; bracteoles 12–16(–20), 3–9 mm long; blade of petals narrowly ovate, auriculate, claws united in a tube 2–4 mm long; sepals 10–11 mm long, united at the base in a tube 2–3 mm long. subsp. *chimantensis*.

5a. Stegolepis parvipetala Steyermark subsp. **parvipetala**.

Type. Flowers small, dull yellow, segments recurved or spreading back, bracts dull orange, leaves erect, grass green on one side, silvery-green on the other, forested south-facing slopes overlying sandstone on ''Cave Rock'' above ''Cave Camp,'' alt. 1810 m, Ptari-tepuí, Bolívar, Venezuela, 29 Oct 1944, *Julian A. Steyermark 59514* (holotype F, isotypes NY, VEN, US).

Distribution. Apparently collected otherwise only from the type locality, viz., *Maguire & Wurdack 33873*, in 1952. The specimens of this collection in gross features strongly resemble *S. guianensis*.

5b. Stegolepis parvipetala Steyermark subsp. **chimantensis** Maguire, subsp. nov.

Perennes; vaginis 15–25 × 6–7 cm; laminis ad 13 dm longis, 6 cm latis; pedunculis 3–4 mm crassis, sursum trigonis dilatis 8–15 mm crassis; spiculis 70–100 vel plus, 10–12 mm longis sepalis inclusis; bracteolis 12–16(–20), 3–9 mm longis; petalis 12–16 mm longis anguste ovatis, auriculatis, unguibus in tubo 2–4 mm connatis; sepalis 10–11 mm longis, unguibus in tubo 2–3 mm connatis.

Type. Petals orange-yellow, anthers orange, bracts dull orange, leaves rich green above, silvery below, frequent in rocky savanna bordering zanjones NE cumbre camp at alt. 1865 m, 19 Feb 1955, Chimantá-tepuí, Estado Bolívar, Venezuela, *Julian A. Steyermark & John J. Wurdack 944* (holotype NY, isotypes VEN, US, K, F, BRAS).

Distribution. The high altitude variant of the mesas of the western Gran Sabana. VENEZUELA. Estado Bolívar: Auyán-tepuí at alt. 2200 m, *Tate 1112* (NY). Chimantá-tepuí: Abacapa-tepuí at alt. 2100 m, *Steyermark 74956* (NY), alt. 2000 m, *Steyermark 75748* (NY); Churi-tepuí at alt. 2250 m, *Wurdack 34250*.

6. Stegolepis choripetala Maguire, sp. nov.

Herbae perennes terrestres 2–3 m altae; caudicibus crassis carnosis 0.5–3.0 dm longis; foliis 5–9 distichis; vaginis conduplicatis equitantibus, in uno plano dis-

positis, 20–30 cm longis, 5–6 cm latis, coriaceis, eligulatis, scarioso-marginatis, ad basim marginis plus minusve 1 cm latis, non-evidentur nervatis; laminis 7–25 dm longis, 3.5–5.0 cm latis, subtiliter 80–100-nervatis, apice falcato subacuto, costa prominenta; pedunculis axillaribus 5–7 per lamina, ferme 8–12(–18) dm longis, 2–3 mm crassis, in sicco sulcatis, sursum compresso-dilatis 3–4 mm latis; capitulis compressis, 15–18(–30)-floribus, 2–3-seriatis; spiculis ca. 15 mm longis, sepalis inclusis; bracteolis 12–14-gradatis, exterioribus 2 mm longis, 3 mm latis, orbiculari-obovatis, obtusis, leviter 3-nervatis, apice subcucullato, interioribus late elliptico-lanceolatis, 5.0–6.5 mm longis, obtusis, leviter 5-nervatis; sepalis liberis oblongo-lanceolatis, subacutis, naviculoideis 9–10(–12) mm longis, leviter 7–9-nervatis, basi 2–3 mm membranacea; petalis 8–10 mm longis, unguibus 4–5 mm longis, 2.5–3.0 mm latis, carnosis, papillosis; laminis 4–5 mm longis, lanceolatis, ca. 3 mm latis, delicatis, acutis minute auriculatis, margine minute crispo; filamentis liberis 4–5 mm longis, uninervis ca. 1.5 mm latis, antheris ca. 5 mm longis sursum angustatis, 4-locularibus, ad basim brevi-auriculatis, poro minuto oblique apicale; ovario 3-loculare, loculis pluriovulatis; stylo trigono acuto; capsulis obovatis ca. 6 mm longis, ad basim membranaceis, sursum induratis, endocarpo crasso, separato ex exocarpo; seminibus 7–8 per loculo, ca. 1 mm diam, valde adpressis angulatis, testa laxa, membranacea pallida.

Type. Post flowering, spikelets radiate; caudex to 15 cm thick, 1.5 m high; leaves to 2.5 m long; best developed in wet breaks of terrace escarpments, Campo Grande, frequent at alt. 1500 m, Cerro Sipapo (Paráque), Amazonas, Venezuela, 10 Dec 1948, *Bassett Maguire & Louis Politi 27573* (holotype, NY). Paratypes. Cerro Sipapo: Herb to 3 m tall, frequent border scrub bush at alt. 1500 m, *Maguire & Politi 28575;* infrequent, stream banks at alt. 1400 m, *Maguire & Politi 28118;* frequent marshy places at alt. 2000 m, *Maguire & Politi 28355;* Sabana Grande at alt. 1500 m, *Maguire & Politi 28695.*

Distribution. Known only from the summit of Cerro Sipapo, Amazonas, Venezuela, but there of wide distribution.

Stegolepis choripetala is quite common on the summit of Cerro Sipapo, sometimes occurring densely about the edge of the cumbre. In higher thickets the plants attain the considerable height of 3 meters. This Sipapo species is most closely related to *S. parvipetala* Steyerm., known only from Ptari-tepui in the eastern Gran Sabana region, in which the corolla is connate into a tube, and the flowers and heads considerably larger. *S. choripetala* further seems to be the connecting link with the segregate genus *Epidryos* because of separable endocarp and small anthers that dehisce by a rounded obliquely apical pore.

7. **Stegolepis steyermarkii** Maguire, sp. nov.

Herbae perennes ad 8 dm altae, terrestres vel subepiphyticae; caudicibus compressis; vaginis conduplicatis subinduratis, lanceolatis, 15–20 cm longis, 4–5 cm latis, scario-marginatis, evidentur nervatis; laminis lineari-lanceolatis, 4–6 dm longis, 2.5–3.5 cm latis, falcate acuminatis, costa prominentissima, venis primariis prominulis 1.4–2.0 mm apartis; pedunculis 1.5–2.5(–3.0) mm diam, nervatis, vulgo 4–6 per axillis foliorum; inflorescentiis essentialiter globosis vulgo 2.0–2.5 mm diam; spiculis vulgo 30–40, fusiformibus, 12–14 mm longis, 3–4 mm diam; bracteolis ca. 16, gradatis, oblongo-lanceolatis, exterioribus ca. 3 mm longis, interioribus ca. 8 mm longis, apice obtuso, cucullato; sepalis 3, breve connatis ad basim, laminis induratis naviculatis, lanceolatis, ca. 10 mm longis, ca. 2.5 mm latis; petalis 3, 10–12 mm longis, unguibus ca. 2 mm connatis, 5-nervatis, laminis

oblongo-lanceolatis, impercepte venatis; staminibus 6, filamentis breve unquibus adnatis, ca. 4 mm longis; antheris 4-locularibus, evidentur introrsis, ca. 6 mm longis, loculis posterioribus apice 0.3–0.4 mm productis; ovario 3-loculare, loculis pluriovulatis; stylo subulato-trigono, ca. 12 mm longo; capsulis induratis 4–5 mm longis; seminibus dorsi-ventrale compressis, oblongo-disciformibus vel plusminusve obovatis vel prismaticis, 1.2–1.8 mm longis, alveolatis, cum membranis evanescentibus investis.

Type. Common terrestrial and also epiphytic on lower parts of tree; Ueitepuí, 125 km south of El Dorado between Luepa and Cerro Venamo, at alt. 1100–1400 m, Estado Bolívar, Venezuela, 7 Mar 1962, *Julian A. Steyermark & Leandro Aristeguieta 17* (holotype NY, isotype VEN). Paratypes. Estado Bolívar: Cerro la Danta, alt. 1040–1060 m, 13 Abril 1960, *Steyermark & Nilsson 48* (NY); Cerro Venamo at alt. 1400–1450 m, 1 Enero 1964, *Steyermark, Dunsterville & Dunsterville 92498* (NY).

Distribution. Known only from the sandstone areas of the northeastern periphery of the Gran Sabana, Estado Bolívar, Venezuela. Additional specimen: Fila de la Danta at alt. 1200 m, 18 Abril 1960, *Steyermark & Nilsson 296* (NY). *Vareschi & Foldats 4768* from Auyán-tepuí is doubtfully referred here.

8. **Stegolepis ferruginea** Baker, Jour. Bot. **20**: 331. 1882.

Type. Kaieteur Savanna, British Guiana, *Jenman 956* (holotype K).

Distribution. Savannas of the Kaieteur Escarpment at the Kaieteur Falls, and the eastern Pakaraima Mountains. BRITISH GUIANA. Kaieteur Plateau: in sandy crevices on sandstone flat, leaves 4 to 5, inflorescence orange, red-brown when mature, alt. 1300 ft, May 1926, *Altson 540* (NY, RB); perennial to 1.3 m high, leaves in a single plane, flower stems 2–4 in the leaf axils, flower heads red-orange, frequent in wet places on savanna, 9 May 1944, *Maguire & Fanshawe 23320* (A, VEN, F, K, NY, US, U); bracts bright orange, petals pale sulphur-yellow, damp shady places under trees or *Brocchinia*, 28 Aug 1933, *Tutin 627* (US); terrestrial or subepiphytic, forests, Merumé Mountains, Partang River, affluent of Mazaruni, at alt. 2050 ft, infrequent, 30 June 1960, *Tillett, Boyan & Tillett 43943*.

II. **Stegolepis** sect. **Pungens** Maguire, sect. nov.

Capitulae valde compressae, pauciflorae vel pluriflorae.

9. **Stegolepis pungens** Gleason, Bull. Torrey Club **58**: 337. 1931.

Type. Savanna Hills, alt. 4400 ft, Cerro Duida, Amazonas, Venezuela, Aug 1928–Apr 1929, *G. H. H. Tate 1043* (holotype, NY).

Distribution. Known only from the type locality, Cerro Duida. Additional specimens seen: VENEZUELA. Amazonas, Cerro Duida: Leaves in fan-shaped wide-spreading cluster, corolla orange and yellow, leaves coriaceous, deep rich green, Savanna Hills, alt. 1025–1200 m, 2 Sept 1944, *Steyermark 58224* (VEN, F, US); Brocchinia Hills, 4 Jan 1929, *Tate 591* (NY, US): Savanna Hills, *Tate 1043* (NY); coarse perennial herb with thick sigmoid caudex, caudexes to 1 m high, branched at base, flowers yellow; occasional, forming thickets in open scrub, north slopes and ridges, Caño Negro Basin, alt. 2000–2300 m, 23 Nov 1950, *Maguire, Cowan & Wurdack 29669*.

10. Stegolepis squarrosa Maguire, sp. nov. Fig. 10, A–D.

Plantae magnae herbae terrestres; laminis foliorum 7–9 dm longis, 5–7 cm latis, coriaceis, 10–12 nervis primariis prominulis, apice falcato acuto; pedunculis 4–5 mm crassis, striatis in sicco sursum trigonis dilatis 10–15 mm latis; capitulis compressis (10–)15–25(–40)-floribus, spiculis sessilibus ca. 2 cm longis; bracteolis 22–24, squarrosis in sicco, bracteolis exterioribus acute oblique triangularibus carinatis enervis, punctato-striatis, interioribus 16–17 mm longis, lanceolatis, subulato-acuminatis, basi membranacea, leviter 3–5-nerva, apice indurato rufo-brunneo; sepalis 20–22 mm longis, lanceolatis, brevi-subulato-acuminatis, concavis, induratis, liberis, basi membranacea 7-nerva; petalis ca. 30 cm longis, 20 mm latis, laminis obcordatis apiculatis venis dichotomis, unguibus crassis liberis; filamentis compressis 1-nervis a unguibus adnatis, 4–5 mm liberis; antheris ca. 9 mm longis angustatis sursum valde undulatis, 4-locularibus, loculis posterioribus 0.5 mm productis; ovario 3-loculare, loculo pluriovulato; seminibus non-visis.

Type. Perennial herb 2 m high, leaves thickly coriaceous, bracteoles of spikes squarrose; bog plants often forming dense, extensive nearly pure stands, open savanna, alt. 1800 m, 1 km south Cumbre Camp, 29 Dec 1951, Cerro Guaiquinima, Río Paragua, Estado Bolívar, Venezuela, *Bassett Maguire 32795* (holotype NY). Paratype. Large marsh herb with compressed caudex branched at base, 2–10 dm high, leaves two-ranked, flower yellow in compressed head, abundant in marshy savanna vic. Cumbre Camp, alt. 1800 m, *Maguire 33033.*

Distribution. Known only from Cerro Guaiquinima, but there abundant; alt. 1500–1740 m, 1943, *F. Cardona sine no.;* alt. 1500–1800 m, *F. Cardona sine no.,* 15 Julio 1944 (VEN); Valle del Alto Río Paragua, Guayana, *F. Cardona 1059* (VEN, US); forming extensive ''forests'' in Caño Impossible drainage, alt. 1700 m, plants to 1.5 m high, abundant, 30 Dec 1951, *Maguire 32839;* in thickets with *Brocchinia tatei,* trail slope below West Escarpment, alt. 1500 m, 31 Dec 1951, *Maguire 32873;* bog-marsh herb 1–3 m high, abundant, high shrub savanna, Valley of Caño Impossible, alt. 1500 m, 10–12 Jan 1952, *Maguire 33064;* leaves narrow, peduncles acutely angled, lowest limit of Savanna Hill, alt. 1400 m, *Maguire 33100.*

Stegolepis squarrosa is related to *S. pungens* of Cerro Duida and *S. ptaritepuiensis* of Ptari-tepuí. It is readily distinguished from both by its more numerous spikelets and squarrose bractlets; from the former by its much smaller spikelets and apiculate petals, and from the latter by its much coarser and broader leaves, much thicker peduncles, which are trigonous rather than compressed at the summit.

11. Stegolepis neblinensis Maguire, sp. nov. Fig. 10, E–J.

Herbae perennes ad 5–8 dm altae; vaginis subinduratis valde conduplicatis, 3.5–4.5 cm latis, 10–18 cm longis, valde scario-marginatis, auriculis prominentibus rotundatis ca. 3–5 mm longis; laminis lineari-lanceolatis, (2–)3–6 dm longis, 1.5–2.5 cm latis, apice subfalcate acuto, costa prominenta, venis primariis, prominulis 0.4–0.8 mm apartis; pedunculis axillaribus 2–4, vulgo 3–5 dm longis, prominente nervatis, 1.5–4.0 mm latis, plus-minusve compressis; capitulis 1–3-floribus compressis; spiculis ovatis, magnis, sepalis inclusis, 2.5–3.5 cm longis, 1.0–1.5 cm latis, 2 bracteis deltoideo-acuminatis 6–7 mm longis subtendtibus; bracteolis 24–28 induratis deltoideo-acuminatis vel lanci-acuminatis, anguste scario-marginatis, 8–20 mm longis, 4–6 mm latis, apice acute acuto vulgo minute

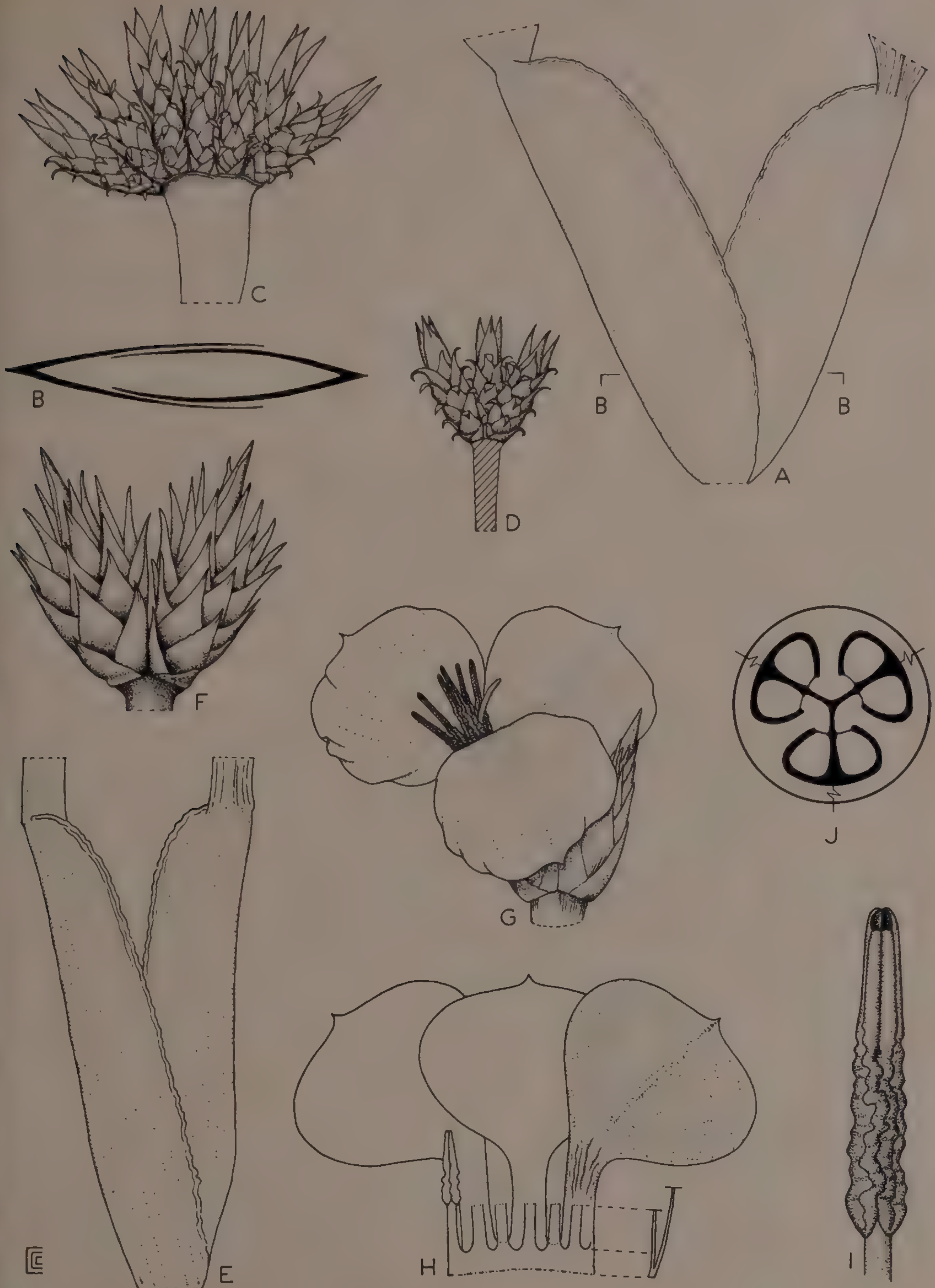

FIG. 10. *Stegolepis squarrosa* (A–D, *Maguire 32795*). A, habit, × ¼. B, cross-section through leaf-sheaths, × ½. C, inflorescence, × ⅞. D, cross-section through inflorescence, × ⅝. *Stegolepis neblinensis* (E–J, E, *Maguire, et al, 37214;* F, *Maguire, et al, 37107*). E, habit, × ⅓. F, inflorescence, × 1. G, spikelet, × 1. H, corolla, × 1¼. I, anther, ventral view, × 5. J, diagram of cross-section through ovary, × 7½.

carinato; sepalis 3, plus-minusve liberis, lanceolatis 26–28 mm longis, laminis induratis 16–18 mm longis, unguibus scariis ca. 10 mm longis, ca. 3 mm latis, 7–9-nervis; petalis 3, 3–4 cm longis, unguibus liberis, 1.0–1.5 cm longis, 3–4 mm latis, valde 7-nervis, laminis 2.0–2.5 cm longis, 1.5–2.5 cm latis, late obovatis, obcordatis, apiculatis; staminibus 6, appositi-sepalis cum unguibus 2 mm adnatis, appositi-petalis plus-minusve liberis, filamentis planis, scariosis, 12–14 mm longis, ca. 1 mm latis, 1-venis; antheris 9–10 mm longis, 4-locularibus, loculis posterioribus apice ca. 0.5 mm obtuso productis; ovario 3-loculare, loculis pluriovulatis; stylis subulato-trigonis 12–14 mm longis; seminibus mihi ignotis.

Type. Scapes usually 2–3 per plant, petals yellow obcordate apiculate, heads 1–2(–4), one scape usually monocephalous, the other usually bicephalous, abundant in open savanna, West Headland, 5 km W Cumbre Camp at alt. 2000 m, Cerro de la Neblina, Amazonas, Venezuela, 6 Jan 1954, *Bassett Maguire, John J. Wurdack & George S. Bunting 37107* (holotype NY, isotypes VEN, US, K, COL, BRAS). Paratypes. Neblina: *Maguire, Wurdack & Bunting 37159; Maguire, Wurdack & Maguire 42394.*

Distribution. Presently known from Cerro de la Neblina, Terr. Amazonas, and Auyán-tepuí, Estado Bolívar. VENEZUELA. Neblina: *Maguire, Wurdack & Bunting 37214, 37104.* Auyán-tepuí: planta que crece en la parte superior, flores amarillas, bastante, alt. 2300 m, Abril 1956, *Vareschi & Foldats 4864* (VEN), *4910* (NY); alt. 2200 m, Dec 1938, *Tate 1108* (NY).

With the material now at hand, it is not useful to attempt to distinguish the two considerably disjunct populations, i.e., those of Neblina in Amazonas, and Auyán-tepuí of the Gran Sabana, some 700 km distant, as distinct subspecific taxa.

12. **Stegolepis ptaritepuiensis** Steyermark, Fieldiana Bot. **28**: 133. 1951.

Type. Flowers large, yellow, common type in swamp on open level portion of plateau on southeast-facing slopes, Ptari-tepuí, alt. 1600 m, Edo. Bolívar, Venezuela, 1 Nov 1944, *Julian A. Steyermark 59655* (holotype F, isotypes GH, US).

Distribution. Wet savannas, Gran Sabana, Bolívar, Venezuela. VENEZUELA. Bolívar: planta macolluda de hojas imbricadas en la base y flores amarillas trimeras; en sabanas, Kavanayén, Guayana, alt. 1300 m, 27 Mayo 1946, *Lasser 1727* (NY); common on wet ground with *Brocchinia*, Gran Sabana, between Mission of Santa Teresita de Kavanayén northwest to Río Karuai, alt. 1220 m, 26 Oct 1944, *Steyermark 57365* (F, NY).

The immediate relationship of *S. ptaritepuiensis* clearly lies with *S. neblinensis.*

13. **Stegolepis celiae** Maguire, sp. nov. Fig. 11.

Herbae perennes ad 1 m altae; caudicibus saepe decumbentibus, ad 1 m longis; foliis ingentibus; vaginis induratis conduplicatis anguste scarioso-marginatis, 18–25 cm longis, 7–10 cm latis, non-evidentur nervatis; auriculis rotundatis 6–10 mm altis; laminis coriaceis, late lineari-lanceolatis, 5–8 dm longis, 5–9 cm latis, apice obtusiusculo subfalcato plus-minusve triangulare ad 14 mm lato, costa non-evidentur, venis prominulis, numerosis ca. 0.5–0.8 mm apartis; pedunculis 3–4 axillis foliorum dispositis, 6–8 dm longis, compressis, 6–8 mm latis, nervatis; prophyllis ca. 20 cm longis, conduplicatis papyraceis ca. 1.5 cm latis; spiculis (20–)30–50, 12–16 mm longis anguste lanceolatis, 3–4 mm latis; bracteolis 20–22, lanceolatis, 7–11 mm longis, 1.5–3.0 mm latis, apice acuminato, vulgo aristato;

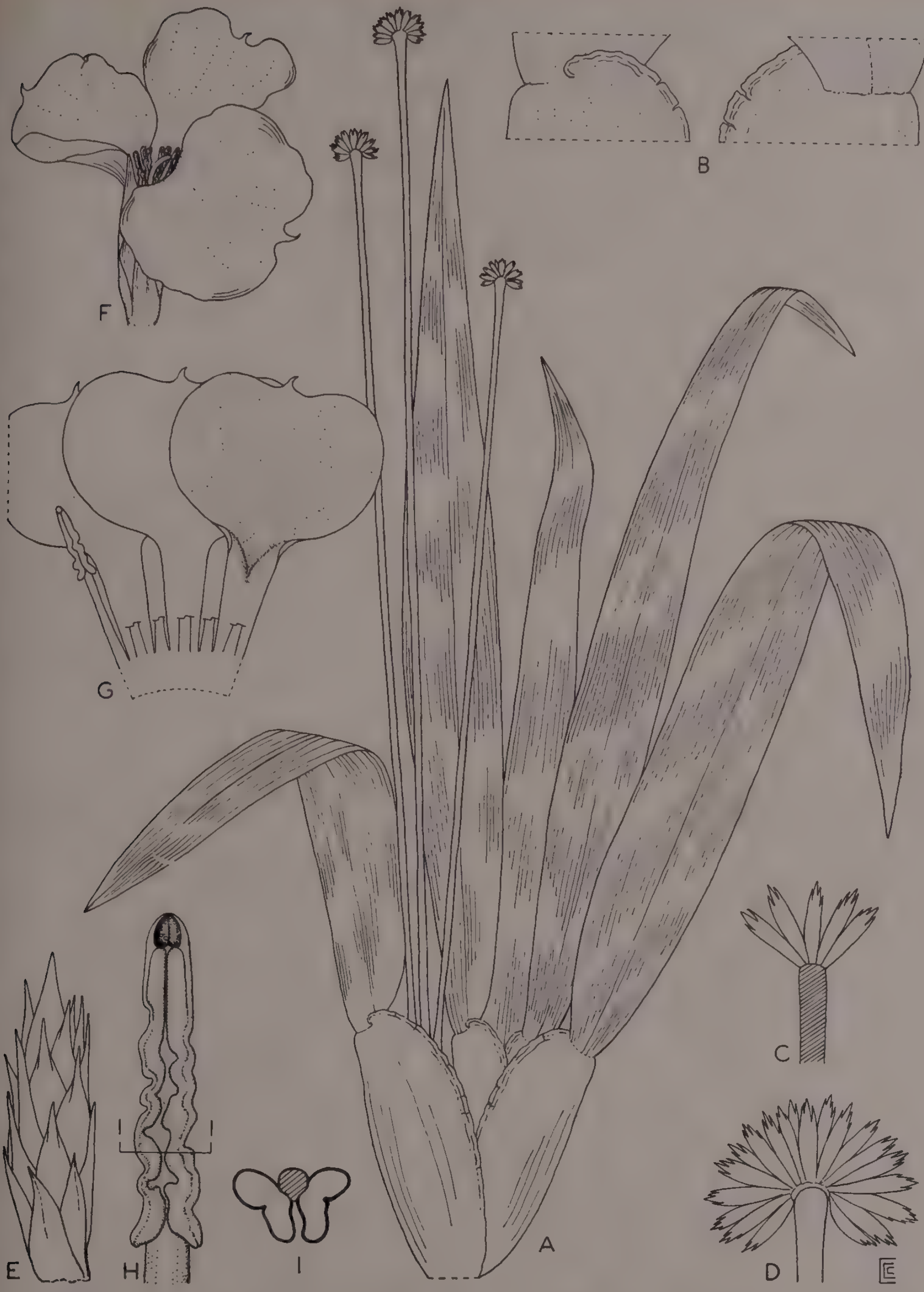

FIG. 11. *Stegolepis celiae* (A, B, *Maguire, et al, 42115*; C–I, *Maguire, et al, 42456*). A, habit, × 1/6. B, adverse views of sheath summit, showing auricles and union with blade, × ½. C, cross-section of inflorescence, × ¾. D, lateral view of inflorescence, × ¾. E, spikelet, × 3. F, spikelet with open flowers, × 2. G, diagram of open flower, × 2.2. H, ventral view of anther, × 10. I, diagram of cross-section of anther, × 15.

sepalis 3, lanceolatis, 11–12 mm longis ca. 3 mm latis; petalis 3, brevi-connatis, 2.2–2.5 cm longis, 1.5–1.8 cm latis, laminis late obcordatis, apiculatis, multi-venis, unguibus ca. 9-venis; staminibus 6, evidenter introrsis, filamentis planis 1-nervis, 6–7 mm longis, antheris lanceolatis, 3.5–4.5 mm longis, 4-locularibus, uniporis, loculis posterioribus apice ca. 0.6 mm productis; ovariis 3-locularibus, brevirostratis, loculis pluriovulatis; stylis subulatis 7–9 mm longis; seminibus mihi ignotis.

Type. Flowers golden yellow, very fragrant, scapes 3 per leaf-axil, subtended by 3 prophylls, petals obcordate, 2.0 × 1.8 cm, frequent in low-bush slopes vicinity Cumbre Camp, alt. 1800 m, Cerro de la Neblina, Amazonas, Venezuela, 4 Jan 1954, *Bassett Maguire, John J. Wurdack & George S. Bunting 37055* (holotype NY, isotypes VEN, US, K, BRAS, F, GH). Paratypes. Cerro de la Neblina: stem base 20–30 cm wide, decumbent, inner leaf-sheaths crisp, edible, West Escarpment at alt. 2000 m, *Maguire, Wurdack & Bunting 37138;* rim Cañon Grande at alt. 1800 m., *Maguire, Wurdack & Maguire 42456.*

Distribution. Common on open scrub exposures, collected only from Cerro Neblina. VENEZUELA. Amazonas, Neblina: caudex sprawling to 1 m long, *Maguire, Wurdack & Bunting 36920, 37349, 36840, 37171; Maguire, Wurdack & Maguire 42115, 42333.*

Stegolepis celiae is a well defined species, having the most numerous and smallest spikelets of the section. Contrastingly, its leaves and sheaths are massive, vegetatively resembling most *S. pungens* of Mt. Duida. Clearly, *S. pungens, S. squarrosa* and *S. celiae* form a compact and natural unit. *S. neblinensis* and *S. ptaritepuiensis,* mutually closely related, may because of sometimes reflexed sepals be more correctly placed in the *Pauciflora.*

III. **Stegolepis** sect. **Pauciflora** Maguire, sect. nov.

Capitulae compressae, uniflorae vel pauciflorae, sepalis in anthesis reflexis.

IIIC. **Stegolepis** sect. **Pauciflora** subsect. **Pauciflora** Maguire, subsect. nov.

Capitulae ebracteatae.

14. **Stegolepis pauciflora** Gleason, Bull. Torrey Club **58**: 336. 1931.

Type. Summit of Ridge 22A, Aug 1928–Apr 1929, Cerro Duida, Amazonas, Venezuela, *G. H. H. Tate 1008* (holotype NY).

Distribution. Known only from Cerro Duida. VENEZUELA. Amazonas, Cerro Duida: Leaves in fan-shaped arrangement, petals orange-yellow, summit on high moist ridge top, alt. 1820–2075 m, 4 Sept 1944, *Steyermark 58330* (NY, VEN, F, US); crest of Ridge 25, alt. 6300 ft, 26 Nov–16 Dec 1928, *Tate 527* (NY).

15. **Stegolepis hitchcockii** Maguire, sp. nov.

Herbae perennes; vaginis distichis equitantibus, chartaceo-subcoriaceis conduplicatis 10–20 cm longis, 5.0–8.5 cm latis, plus-minusve nervatis, marginis firme scariosis, auriculis rotundatis ca. 1 cm longis, 2–3 cm latis; laminis coriaceis 7–9 dm longis, 4–7 cm latis, apice subacuto, nervis primariis laminarum improminulis, ca. 0.6–1.0 mm apartis; pedunculis axillaribus 4–6 per axillis, 1.5–3.0 mm diam, 5–6 dm longis sursum compressis aliquantulum dilatis; floribus 1–6, 1–2-seriatis; spiculis 15–18 mm longis, sepalis inclusis; bracteolis ca. 18, anguste deltoideo-lanceolatis enervis naviculoideis, exterioribus ca. 4 mm longis, 1.2 mm latis, interioribus ca. 9 mm longis, 2 mm latis; sepalis 16–18 mm longis, unguibus 6 mm longis, ca. 2 mm latis, membranaceis ca. 2 mm connatis, laminis late lanceolatis induratis ca. 14 mm longis, valde involutis acutis, marginibus anguste scariosis, in anthesis reflexis vel deciduis; petalis late obovato-obcordatis, apiculatis subcarnosis, plus dichotomate venis, unguibus ca. 6 mm longis, 2 mm latis, 7-nervis 2 mm connatis, laminis 12–14 mm longis, ca. 18 mm latis; filamentis ca. 2.5 mm in tubo connatis, 5 mm liberis, uninervis; antheris lanceolatis, 4–5 mm longis, ca. 1 mm latis, undulatis, 4-locularibus; ovario 3-loculare, loculis pluriovulatis; seminibus mihi non visis.

Key to the Subspecies of *Stegolepis hitchcockii*

1. Leaf-sheaths oblong, blades commonly 3–4 cm wide; spikelets, including sepals, 15–16 mm long; bracteoles obtusish, subcucullate, not-margined. subsp. *hitchcockii.*

1. Leaf-sheaths ventricose, blades commonly 4–5 cm wide; spikelets, including sepals, 17–18 mm long; bracteoles acutish, not at all cucullate, narrowly pale margined. subsp. *morichensis.*

15a. Stegolepis hitchcockii Maguire subsp. **hitchcockii.**

Vaginis oblongis, nervis evidentur, valde marginatis; spiculis, sepalis inclusis, 15–16 mm longis; bracteolis obtusiusculis emarginatis.

Type. Herb with yellow flowers, open places near summit, Serranía Parú at alt. 1500 m, Caño Asisa, Río Ventuari, Terr. Amazonas, Venezuela, 3 Feb 1949, *Kathleen D. Phelps & C. B. Hitchcock 535* (holotype NY).

Distribution. Apparently a local race confined to Cerro Parú: frequent, caudex to 1 m long, scapes 7–10 per plant, flowers yellow, sabanita and scrub forest at 2000 m alt., *Cowan & Wurdack 31194.*

15b. Stegolepis hitchcockii Maguire subsp. **morichensis** Maguire, subsp. nov.

Vaginis plus-minusve valde ventricosis, enervatis, inconspicue marginatis; spiculis, sepalis inclusis, 15–16 mm longis; bracteolis acute marginatis.

Type. Frequent, scapes 6–10, flowers yellow, in savanna at alt. 800 m., Cerro Moriche, Río Ventuari, Terr. Amazonas, Venezuela, 14 Jan 1951, *Bassett Maguire, Richard S. Cowan & John J. Wurdack 30912* (holotype NY).

Distribution. Material at hand presently is from the Cerros Moriche and Yapacana, both lesser sandstone mountains. VENEZUELA. Amazonas: Cerro Moriche, *Maguire, Cowan & Wurdack 30858, 30965.* Cerro Yapacana: caudex to 1 m high, ca. 25 cm across, scapes 5–8, axillary, flowers yellow, 1–5 per inflorescence, leaf-blades to 1 m long, 10 cm broad, sheaths to 20 cm long, frequent in ravines on cumbre at alt. 1200 m, 3 Jan 1951, *Maguire, Cowan & Wurdack 30674, 30715;* base of escarpment, *Maguire, Cowan & Wurdack 30620.*

The smaller sandstone mountains, Yapacana and Moriche, are areally and ecologically well isolated from the larger massif Parú. It is perhaps because of this isolation that the minor but distinct differences between the two subspecies are maintained. With sufficient material, a minor statistical difference between the populations on Moriche and Yapacana might be established.

16. Stegolepis pulchella Maguire, sp. nov.

Herbae perennes terrestres 1.0–1.5 mm altae; foliis 5–7 distichis; vaginis valde equitantibus in uno plano dispositis, 10–15 cm longis, conduplicatis, sursum 3.0–3.5 cm latis, enervis, subinduratis, marginis late et conspicue albidoscariosis, apice late auriculato, auriculis rotundatis 2–3 cm latis, conspicue albomembranaceis; laminis 7–10 dm longis, 2.5–3.5 cm latis, apice brevi-subfalcato-acuto, nervis primariis prominulis, ca. 20, costa ca. 1 mm crassa; pedunculis 8–12, axillaribus, 5–7 dm longis, 1–2(–3) mm crassis, compressis vel trigonis sulcatis, in sicco sursum compressis aliquantulum dilatis; floribus paucis 1–3(–4); spiculis sessilibus fusiformibus, 18–22 mm longis, sepalis inclusis; bracteolis 16–20 gradatis, lanceolatis obtusiusculis, exterioribus inaequaliter lanceolatis, 3.5–4.2 mm longis, ca. 2 mm latis, subacutis, interioribus angustioribus 11 mm longis, 2.8 mm latis, leviter 3–5-nervis; sepalis 20–22 mm longis, unguibus ca. 4 mm longis, pluri-nervis, ad basim in tubo 2.0–2.5 mm connatis, laminis induratis ca. 16 mm longis, 3 mm latis, valde involutis naviculoideis acutis, in anthesis reflexis; petalis 28–30 mm longis, unguibus ca. 6 mm longis, 3.5 mm latis, 7–9-nervis; laminis ca. 22–24 mm longis, 27–28 mm latis, obcordatis, apiculatis, dichotomate venis, apiculo ca. 2.5 mm longis; filamentis in tubo 3 mm longo connatis, partis liberis 4.5–5.0 mm longis, angustis, 1-nervis; antheris 9.5–10.5 mm longis, sursum angustatis, 4-locularibus, non valde undulatis; ovario 6–7 mm longo, 3-loculare ad basim constricto, sursum globoso indurato, loculis pluriovulatis; seminibus subpyramidalibus, striatis, rufo-brunnescentibus.

Type. Herb with yellow flowers, common on open rocky scrub savanna, Campo Grande at alt. 1500 m, 15 Jan 1949, Cerro Sipapo, Terr. Amazonas, Venezuela, *Bassett Maguire & Louis Politi 27555* (holotype NY).

Distribution. Known only from the type locality and the geographically proximal Cerros Guanay and Camani. VENEZUELA. Amazonas, Cerro Sipapo: *Maguire & Politi 27878;* Cerro Guanay: *Maguire, Phelps, Hitchcock & Budowski 31744;* Cerro Camani: *Maguire, Phelps, Hitchcock & Budowski 31694, 31820.*

Stegolepis pulchella and *S. membranacea* are readily distinguished from *S. hitchcockii* because of its strongly coriaceous leaf-blades with inconspicuous midrib primary veins.

17. **Stegolepis membranacea** Maguire, sp. nov.

Herbae perennes ad 1.5 m altae; vaginis papyraceis, evidentur nervosis haud induratis; auriculis rotundatis, submembranaceis sed non-scariosis; laminis lineari-lanceolatis, ad 8 dm longis, 2.5–3.5 cm latis; costa fere prominenta; venis primariis prominentibus 0.5–1.0 mm apartis; pedunculis vulgo 5–8, aliquantum compressis vel angulosis, nervatis, ad 5 dm longis; floribus 1–2; spiculis, sepalis inclusis, 16–18 mm longis; bracteolis 18–20, anguste triangulari-lanceolatis, gradatis, 4–7 mm longis, obtusiusculis, anguste marginatis; petalis 3, laminis obcordatis, flabellatis, dichotomate venis; staminibus 6, lanceolatis, rugosis; ovario 3-loculare, pluri-ovulato; seminibus mihi ignotis.

Type. Flowers yellow, frequent, North Escarpment at alt. 1800 m, Cerro Huachamacari, Río Cunucunuma, Río Orinoco, Terr. Amazonas, Venezuela, 18 Dec 1950, *Bassett Maguire, Richard S. Cowan & John J. Wurdack 30324* (holotype NY).

Distribution. Known only from Cerro Huachamacari and the adjacent floristically similar Cerro Duida. VENEZUELA. Amazonas, Cerro Duida: *Maguire, Cowan & Wurdack 29560, 29620, & 29638.*

On Cerro Duida, the two members of the sect. *Pauciflora* present seem to be areally separate, *S. pauciflora* confined to the southern part of the mountain, and *S. membranacea* to the northern escarpment. Morphologically they are quite

distinct, the former with much larger spikelets, indurated leaf-sheaths, broader coriaceous leaves, and much broader enervate peduncles.

18. **Stegolepis wurdackii** Maguire, sp. nov.

Herbae perennes ad 1 m altae; vaginis oblongis vel oblongo-lanceolatis, conduplicatis, induratis, enervatis, ad 18 cm longis, anguste marginatis; auriculis rotundatis 0.5–0.8 cm longis; laminis subcoriaceis ad 7 dm longis, 2.0–3.5 cm latis, acutis; costa prominenta, venis primariis prominulis, 0.7–1.0 mm apartis; pedunculis vulgo (3–)5–15, subfiliformibus, 0.5–0.8 mm diam, ad 6 dm longis; spiculis solitariis, rare duobus, fusiformibus, sepalis inclusis, 23–25 mm longis, ca. 5 mm diam; bracteolis anguste triangulari-lanceolatis, 18–20, 4–11 mm longis, 2.0–2.8 mm latis; sepalis 3, liberis, naviculoideis, acute lanceolatis, 22–24 mm longis, unguibus brevibus 2–3 mm longis ca. 15-nervis percepte quando humidis; petalis 3, essentialiter liberis, flabellatis, 22–24 mm longis, unguibus 4–5 mm longis; laminis late subobcordati-obovatis, 22–24 mm latis, apiculatis, dichotomate venatis; staminibus 6, liberis, introrsus dispositis, antheris lanceolatis rugulosis, 11–12 mm longis; ovario 3-locularibus, loculo pluri-ovulato; stylis subulatis; capsulis seminibusque mihi ignotis.

Key to the Subspecies of *Stegolepis wurdackii*

1. Peduncles 3–5; leaf-blades 1.5–2.5 cm broad. subsp. *wurdackii.*
1. Peduncles 10–15; leaf-blades 2.5–3.5 cm broad. subsp. *chimantensis.*

18a. **Stegolepis wurdackii** Maguire subsp. **wurdackii.**

Pedunculi vulgo 10–15; laminis foliorum 2.5–3.5 cm latis.

Type. Herbaceous perennial with yellow flowers, lower escarpment slopes at alt. 1600 m, 24 Jan 1953, Cerro de la Neblina, Terr. Amazonas, Venezuela, *Bassett Maguire, John J. Wurdack & George S. Bunting 37377* (holotype NY). Paratypes. North Escarpment at alt. 1800 m, Cerro Neblina, 27 Dec 1953, *Maguire, Wurdack & Bunting 36851, 36938.*

Distribution. Known only from the type locality.

18b. **Stegolepis wurdackii** Maguire subsp. **chimantensis** Maguire, subsp. nov.

Pedunculi vulgo 10–15; laminis foliorum 2.5–3.5 cm latis.

Type. Perennial herb with yellow flowers, frequent on damp escarpment of upper waterfalls, eastern face Torono-tepuí (Chimantá-tepuí) at alt. 1950 m, 20 Feb 1955, Edo. Bolívar, Venezuela, *Julian A. Steyermark & John J. Wurdack 976* (holotype NY).

Distribution. Known only from Chimantá: base of main escarpment, alt. 1700 m, above valley, Río Tirica, 16 May 1953, *Steyermark 75463* (NY).

The two disparate populations, subsp. *wurdackii* on Neblina and subsp. *chimantensis* on Chimantá-tepuí, are at once recognized to represent a common species, characterized by essentially identical habit and floral morphology. The Neblina population has become a plant of less robust habit, relatively few peduncles, and slightly larger spicules and flowers. The Chimantá population is more robust, productive of relatively larger numbers and somewhat coarser peduncles, and perceptibly smaller flowers.

The closest relative of *S. wurdackii* is *S. pauciflora* Gleason of Cerro Duida.

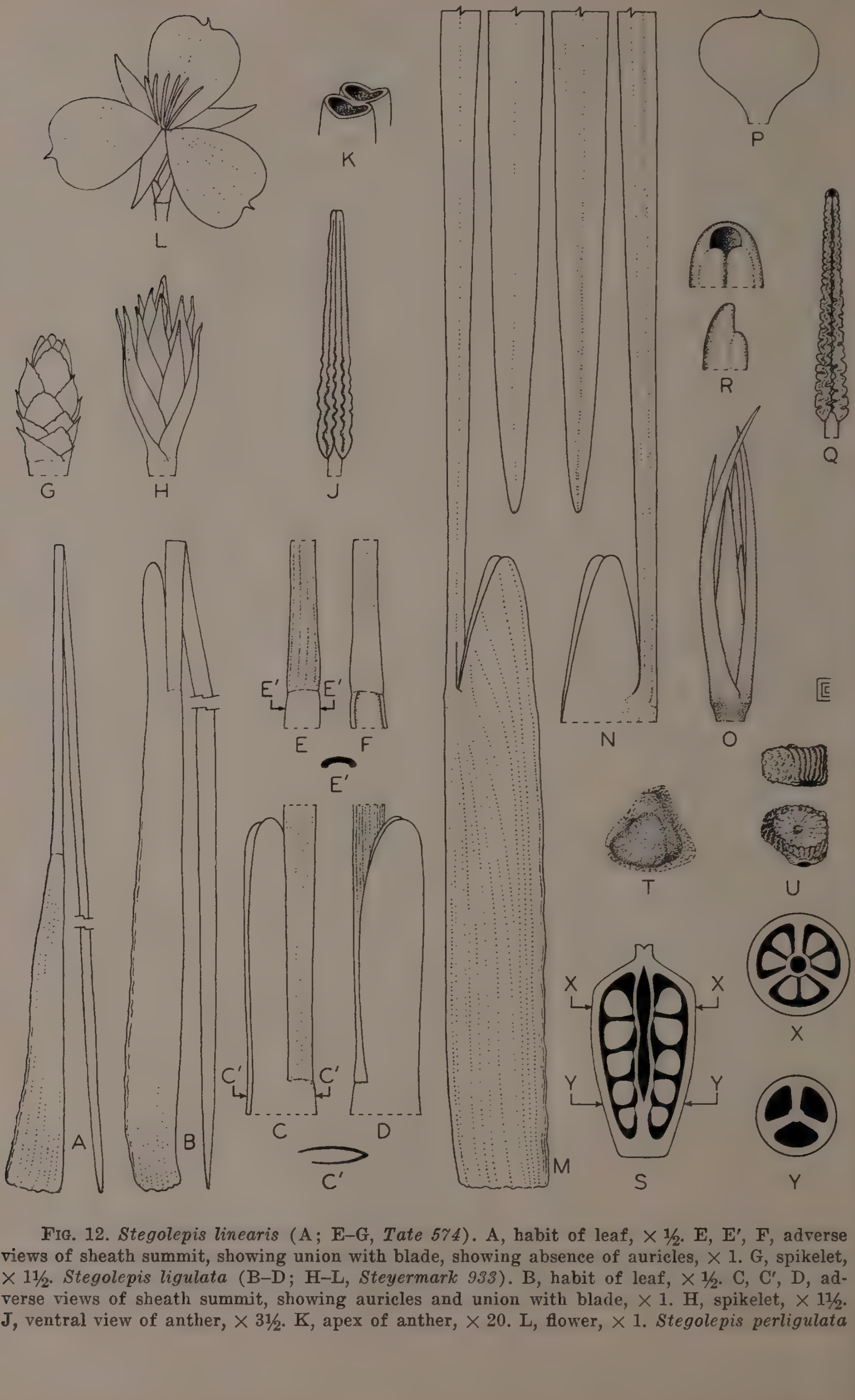

FIG. 12. *Stegolepis linearis* (A; E–G, *Tate 574*). A, habit of leaf, × ½. E, E′, F, adverse views of sheath summit, showing union with blade, showing absence of auricles, × 1. G, spikelet, × 1½. *Stegolepis ligulata* (B–D; H–L, *Steyermark 933*). B, habit of leaf, × ½. C, C′, D, adverse views of sheath summit, showing auricles and union with blade, × 1. H, spikelet, × 1½. J, ventral view of anther, × 3½. K, apex of anther, × 20. L, flower, × 1. *Stegolepis perligulata*

19. Stegolepis ligulata Maguire, sp. nov. Fig. 12, B–D, H–L.

Herbae perennes 5–8 dm altae; caudice brevi; vaginis lanceolatis, conduplicatis, enervatis, induratis, 10–16 mm longis, ad basim 1.5–2.5 cm latis, marginibus late delicateque scariosis, apice in auriculis jugatis, ligulatis lanceolatis ad 4 cm longis productis, obtusiusculis, scario-marginatis; laminis coriaceis linearibus, gramineis, 3–6 dm longis, 5–8 mm latis, valde 7–9-nervatis, internervis scariosis; pedunculis evidentur 3–4, ca. 1.5 mm diam, laevis trigonis; spiculis solitariis vulgo 27–30 mm longis, fusiformibus; bracteolis 16–18, subapproximatis, acuminati-lanceolatis, 7–9-nervis, exterioribus ca. 13 mm longis, interioribus ca. 16 mm longis; sepalis lanceolatis, 24–26 mm longis, unguibus scariosis ca. 7 mm longis, 9–11-venis, laminis induratis 18–20 mm longis, in anthesis reflexis; petalis 3, liberis flabelliformibus ca. 28 mm longis, laminis late obcordatis apiculatis, 18–20 mm longis, 15–16 mm latis, dichotomate venis; staminibus 6, liberis, filamentis planis 1-nervis, hyalinis, ca. 12 mm longis, antheris lanceolatis, debiliter rugulosis, ca. 11 mm longis; poro subterminale, loculis posterioribus aliquantulum productis; ovario 3-loculare, multi-ovulato; seminibus mihi ignotis.

Type. Forming large colonies, scapes 1–3, flowers yellow, abundant in swampy savanna west of lower Cumbre Camp at alt. 1850 m, Chimantá-tepuí, Estado Bolívar, Venezuela, 18 Feb 1955, *Julian A. Steyermark & John J. Wurdack 933* (holotype NY, isotypes VEN, F, GH, K, BRAS). Paratypes. Common in rocky swampy savanna, forming dense colonies, leaves coriaceous yellow-green below with green nerves, petals and anthers golden, rocky plateau southeast-facing escarpment Apacará-tepuí (Chimantá) at alt. 2000 m, 20 June 1953, *J. A. Steyermark 75798* (NY); swampy depression, east headwaters Río Tirica, Chimantá-tepuí, at alt. 2100 m, 12 Feb 1955, *Steyermark & Wurdack 794.*

Distribution. Known by only the cited specimens. *S. ligulata* finds its closest relative in *S. linearis* of Cerro Duida. Habitally the two are most similar. They differ sharply in details of spikelet and in the complete absence of auricular ligules in *S. linearis*.

20. Stegolepis linearis Gleason, Bull. Torrey Club **58**: 335. 1931. Fig. 12, A, E–G.

Type. Peak No. 15 at alt. 6700 ft, Aug 1928–April 1929, Cerro Duida, Amazonas, Venezuela, *G. H. H. Tate 574* (holotype NY, isotype US).

Distribution. Known only from Cerro Duida: leaves grass-green, stems purple-brown as are the bracts, rills on rocky dry ridge top, summit Brocchinia Hills, alt. 1700–1980 m, 1 Sep 1944, *Steyermark 58169* (F); in swamp on slopes of Savanna Hills, alt. 4400 ft, *Tate 781* (NY); swampy slopes of Savanna Hills, alt. 4400 ft, *Tate 734* (NY).

21. Stegolepis cardonae Maguire, sp. nov.

Herbae perennes ad 1 m altae; vaginis probabiliter papyraceis in maturitate, lanceolatis, ad 3 dm longis, conduplicatis 2.5–3.0 cm latis, exauriculatis; laminis

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(M–Y, *Maguire, Steyermark & Maguire 46915*). M, habit of leaf, × ½. N, reverse side of leaf, showing ligulate auricles and union of sheath and blade, × ½. O, spikelet, × 1½. P, petal, × 1. Q, ventral view of anther, × 3½. R, details of apex of anther, × 20. S, diagram of longitudinal section of capsule, × 4. T, seed expanded when wet, × 7½. U, apical view and lateral view of seed when dry, testa removed, × 7½. X, Y, diagrams of cross-section of capsule, × 4.

lineari-lanceolatis, firme papyraceis, ad 8 dm longis, 1.8–2.5 cm latis; costa prominenta; venis primariis prominulis 1–2 mm apartis; pedunculis 4–5, laevis, plurisulcatis, 1.8–2.5 mm latis, ad 6 dm longis, vulgo 3–5-spiculatis; spiculis ca. 12 mm longis, sepalis inclusis, fusiformibus; bracteolis ca. 20, 3–7 mm longis, 2.2–3.2 mm latis, lanceolatis, obtusiusculis, exterioribus carinatis, interioribus distale 1-nervatis; sepalis 3, ca. 18 mm longis, lanceolatis, unguibus 2–3 mm connatis; laminis induratis ca. 12–13 mm longis, lanceolatis, 4–5 mm latis, in anthesis reflexis; petalis 3, ca. 24 mm longis, brevi-unguibus, ca. 3 mm connatis; laminis plusminusve orbicularibus ca. 20 mm longis, dichotomate venosis; staminibus 6, filamentis 3–4 mm urceolare connatis, filamentis liberis ca. 6 mm longis, ca. 0.5 mm diam, haud compressis; antheris introrsis, lanceolatis, ca. 10 mm longis, valde corrugatis, lobis posterioribus co. 0.4 mm longis productis; ovario 3-loculare, loculis pluri-ovulatis; seminibus mihi ignotis.

Type. In colonies on escarpment face and base, flowers yellow, abundant, lower escarpment base at alt. 2050 m, 29 Jan 1953, Churi-tepuí, Chimantá-tepuí, Estado Bolívar, Venezuela, *John J. Wurdack 34263* (holotype NY).

Distribution. Known to me by one other collection: fls. amarilla, en suelo pantanoso, Cerro Acopán, alt. 1500–1800 m, Caroní, Guayana [Estado Bolívar], Octubre 1947, *Cardona 2351* (NY, US).

IIID. **Stegolepis** sect. **Pauciflora** subsect. **Gleasoniana** Maguire, subsect. nov.

Capitulae conspicue lanceolatae bracteatae.

22. **Stegolepis gleasoniana** Steyermark, Fieldiana Bot. **28**: 130. 1951.

Type. Leaves stiff, erect, coriaceous, deep green above, pale green below. bracts and sepals brown, petals deep yellow, southeastern-facing moist sandstone bluffs near Caño Negro, tributary of Caño Iguapo, ca. alt. 1520 m, Cerro Duida, Terr. Amazonas, Venezuela, 26 Aug 1944, *J. A. Steyermark 58040* (holotype F, isotypes NY, GH, US).

Distribution. Known only by the type collection.

23. **Stegolepis perligulata** Maguire, sp. nov. Fig. 12, M–Y.

Herbae perennes ad 1.5 m altae; vaginis exterioribus marcescentibus, firme papyraceis, vaginis interioribus lanceolatis firme papyraceis, ca. 25 cm longis, ca. 3 cm latis, venis prominulis, auriculis ligulatis 3.0–6.0 cm longis, oblongo-lanceolatis, obtusis submembranaceis, ad 1.5 cm latis; laminis lineari-lanceolatis, conspicue punctatis, ad 12 dm longis, 1.4–1.8 cm latis, acutis, costa plus prominenta, ad basim 2.5–3.0 mm lata, ca. 6-venis, venis prominulis, vulgo 3 mm apartis; pedunculis vulgo 6–7, acute trigonis, laevis, sulcatis, 4–6 dm longis, 0.7–1.2 mm crassis, unispicatis; spiculis bracteolis inclusis subtendentibus, 26–30 mm longis, fusiformibus, 3–4 mm diam; bracteis 2, appositis, anguste lanceolatis acutis, exterioribus 26–30 mm longis, ca. 3 mm latis, interioribus 20–25 mm longis, ca. 4 mm latis; bracteolis 6–8, anguste lanceolatis, plus-minusve hyalinis, 3–5-nervis, exterioribus 19–21 mm longis, interioribus ca. 10 mm longis; sepalis 3, 16–18 mm longis, 2.5 mm connatis; laminis lanceolatis, subinduratis, 14–15 mm longis, obscure 5-nervis; petalis 3, late obovatis, unguibus 3 mm connatis; staminibus 6, filamentis ca. 6 mm longis, planis, 1-nervis, 3 mm unguibus petalis adnatis; antheris 4-locularibus, lanceolatis, valde rugulosis, obtusis, lobo posteriore producto; ovario 3-loculare, loculis pluri-ovulatis; capsulis elliptico-oblongis 8–9 mm longis, pluri-seminatis; seminibus prismaticis, pyramidalibus vel compressis, striatis, 1.0–1.5 mm longis, testa plus-minusve carnosa hyalina.

Type. Frequent on escarpment of La Escalera at alt. 850 m, Río Uiri-yuk, Río Cuyuni, Estado Bolívar, Venezuela, 20 Aug 1962, *Bassett Maguire, Julian A. Steyermark & Celia K. Maguire 46915* (holotype NY, isotypes VEN, US, K, GH, BRAS, F).

Distribution. Represented only by the several individual plants of the type collection.

Stegolepis perligulata seems clearly to be the eastern analogue of *S. gleasoniana* collected on Cerro Duida. The habits and habitats of the two species are similar; the two narrowly lanceolate subtending cephalar bracts are to this time found nowhere else in the genus. But in detail these analogous species are sharply distinct, viz., the heads of the smaller flowered *S. gleasoniana* are 1–5-flowered, while in *S. perligulata* strictly 1-flowered; the former is eligulate, the latter with conspicuously large ligulate auricles which become as much as 6 cm long.

Epidryos Maguire, Taxon **11**(2): 57. 1962.

Epiphyton Maguire, Mem. N. Y. Bot. Gard. **10**(1): 31. 1958; not *Epiphyton* Bornemann, Nova Acta Leopoldina, Band 51, p. 16, *pl. 1, figs. 9–10,* 1886.

Key to the Species of *Epidryos*

1. Peduncles subfiliform, 0.5–0.8 mm diam, heads commonly 1–3-flowered.
   2. Bracteoles subindurate, narrowly or not at all scarious; leaf-sheaths ventrally (marginally) ventricose; plants of Panama. 1. *Epidryos allenii.*
   2. Bracteoles semihyaline, broadly scarious; leaf-sheaths ventrally (marginally) rectilinear; plants of eastern Guayana. 2. *Epidryos guayanensis.*
1. Peduncles relatively coarse, 1.0–1.4 mm diam; heads 4–7-flowered; spikelets 8–9 mm long; anthers 2 mm long; undersurface of leaf rather prominently 18–22-nerved; plants of Colombia. 3. *Epidryos micrantherus.*

1. **Epidryos allenii** (Steyermark) Maguire, Taxon **11**(2): 57. 1962.

Stegolepis allenii Steyermark, Field Mus. Pub. Bot. **22**: 325. 1940.
Epiphyton allenii (Steyermark) Maguire, Mem. N. Y. Bot. Gard. **10**(1): 31. 1958.

Type. Epiphyte, growing with orchids and ferns in tops of trees 10 m tall, hills north of El Valle de Anton, alt. 1000 m, Prov. Cocle, Panama, 23 Jun 1940, *Paul H. Allen 2153* (holotype F, photo NY, isotype MO, photo NY).

Distribution. Known otherwise only by *Allen 3748* from the type locality.

2. **Epidryos guayanensis** Maguire, sp. nov.

Herbae perennes epiphyticae; caudicibus brevibus nullis ramosis, vel paucicipitalibus; foliis valde distichis; vaginis conduplicatis subinduratis vel papyraceis, conspicue venis, 12–18 cm longis, 2–3 cm latis, ventrale (laterale) essentialiter rectilinearibus, exauriculatis; pedunculis numerosis (8–11), 4–6 dm longis, filiformibus 0.4–0.5 mm diam, unisulcatis, 1–3 spiculatis; spiculis ca. 12 mm longis, sepalis inclusis; bracteolis gradatis, ca. 14, ovato-lanceolatis vel lanceolatis, valde scariomarginatis, 3–7 mm longis, exterioribus ovato-lanceolatis, interioribus lanceolatis, subhyalinis; sepalis 3, liberis, lanceolatis, ca. 10 mm longis, basibus hyalinis, 5–7-venis; petalis 3, anguste rhomboideo-lanceolatis, aliquantum carnosis; unguibus ca. 4 mm longis, ca. 1.5 mm connatis; staminibus 6, introrsis, filamentis

3–4 mm longis, ca. 0.4 mm latis, ca. 1 mm in cylindro connatis; antheris oblongolanceolatis ca. 2.5 mm longis, subsagittatis, 4-lobatis, evidenter 2-loculis, nonrugulosis, poro terminale dehiscente, lobis posterioribus haud productis; ovario 3-loculare, loculis pluriovulatis; stylo clavato, ca. 4 mm longo; capsulis elliptico-ovatis, 7–8 mm longis, 4–5 mm latis, loculicidale dehiscentibus, exocarpo indurato endocarpo indurato separato; seminibus in sicco maturis prismatico-discoformibus 1.2–1.5 mm diam, nigrescentibus, axiale cum appendice alba testa producta.

Type. Epiphyte with distichous leaves, often in clonal colonies, muscilaginous at base of leaves, frequent, forest, Partang River, at alt. 1200 m, Merume Mountains, Pakaraima Mountains, British Guiana, 3 July 1960, *Stephen S. Tillett, Carolyn L. Tillett & Rufus Boyan 43979* (holotype NY).

Distribution. Known by the type collection from British Guiana, and from adjacent Venezuela by the following paratypes. VENEZUELA. Estado Bolívar: epiphyte forming a circular or rosette of dense clumps, peduncles filiform, pale green, drooping, along main stream or quebrada, forest east of the Río Venamo at alt. 1400 m, 3 Jan 1964, *Julian A. Steyermark, G. C. K. & E. D. Dunsterville 92691* (NY, VEN); Río Venamo, 8 Jan 1963, *Steyermark, Dunsterville & Dunsterville 92852* (NY, VEN); km 119 S of El Dorado, at alt. 1000 m, 12 Jan 1964, *Steyermark, Dunsterville & Dunsterville 93021* (NY, VEN).

Epidryos is unquestionably a derivative of *Stegolepis*, in large probability of the subsect. *Ferruginea* of the sect. *Guianensis*. There is habital similarity with the *Ferruginea*, and in *Stegolepis choripetala* we find a partial or almost complete separation of the endocarp of the capsule from the exocarp, a condition that prevails prominently and characteristically in all species of *Epidryos*.

This small segregate group is of especial interest geographically. It will be recalled that all twenty-three species of the basic genus *Stegolepis* are confined without exception (so far as known) to the sandstone region of Guayana. Of the small aggregate *Epidryos*, its three species are apparently quite localized in strikingly disjunct regions, viz., Panama, where *E. allenii* is narrowly endemic; Colombia, in the low-altitude, high-rainfall Pacific region of the Bay of Choco; and in the Pakaraima Mountains of British Guiana and adjacent Venezuela, the largest of the three disjunct areas (in part coincident with that of *Stegolepis*), from which there are now four ample and well prepared collections.

The mutual isolation of the three areas of occurrence, and the closeness of affinity that *E. guayanensis* holds with *E. allenii* of Panama, raise interesting questions of origin and dispersal of the three biologic elements. One wonders if they originated from the basic stock in Guayana, and then, by some random dispersal, found haven in isolated Panama and coastal Colombia. Or are they relictual of progenitors that were during pre-Andean or inter-Andean time widespread with continuous distribution.

The geographic compactness and restriction of *Stegolepis* would suggest the latter course of events. The sandstones of Guayana—or better the great lens of the Roraima sediments—have almost equally been reduced.

3. **Epidryos micrantherus** Maguire, Taxon **11**(2): 57. 1962.

Epiphyton micranthera Maguire, Mem. N. Y. Bot. Gard. **10**(1): 31. 1958.

Type. Epiphyte, leaves rather thick, deep green, flowers yellow, alt. 70 m, Chuare, Dept. Cauca, Colombia, 23 Dec 1946, *Oscar Haught 5387* (holotype US 1903798, photo NY).

Distribution. Known otherwise by a specimen at Kew labeled "Herb. Lehmannianum, s.n., s. dat.," and *Cuatrecasas 19991*. Buenaventura, Colombia (VALLE).

Rapatea Aublet, Hist. Pl. Gui. Franc. **1**: 305. *pl. 118*. 1775.

Involucral bracts 2, closely subtending the spheroidal, elongated or compressed head; flowers short-pedicelled or sometimes sessile; stamens introrsely inserted, the 4-celled anthers with an apical cochleariform appendage; dehiscence by a single terminal pore; pollen grains subsphaeroidal, apertures ± zonisulcate; ovary 3-celled, each with a single basal ovule, normally 2 (rarely 1) aborting; capsule firmly indurated above the middle; dehiscence loculicidal; seed usually solitary, oblong, without appendage, finely longitudinally striate.

Herbaceous perennials with a short erect at length pluricipital caudex bearing equitant conduplicate leaf-sheaths attached in a sigmoid arrangement.

Type. *Rapatea paludosa* Aubl.

Distribution. Plants of swampy or marshy woodland habitats, usually at low alt.; infrequent in open places.

The genus is widespread, occurring from Colombia and Venezuela southward to Peru and Brazil. It thus has the greatest range of all genera of the family. Eleven of the 18 recognized species are Guayanan.

Key to the Sections and Species of *Rapatea*

1. Spikelets with bracts strongly gradate, except *R. ulei* (sect. *Paludosa*).

2. Leaf-blades broadly to narrowly linear, gradually narrowed at the base to a union with the sheaths.

3. Bractlets of the spikelets acuminate.

4. Leaves broadly linear, normally 4–10 cm or more wide; inflorescence massive, (3–)4–7 cm broad, bracts 10–20 cm long. 1. *R. paludosa* var. *paludosa*.

4. Leaves narrowly linear, less than 4 cm wide; inflorescence less than 4 cm broad; spikelets sessile or essentially so.

5. Bractlets of the spikelets 5–12 mm long, abruptly pungent-attenuate, entire, strongly 3-nerved at the apex. 1b. *R. paludosa* var. *sessiliflora*.

5. Bractlets of the spikelets 5–15 mm long, more gradually pungent-attenuate, minutely serrulate, the upper portion green, strongly 5-nerved at the apex. 2. *R. linearis*.

3. Bractlets of the spikelets obtuse, apiculate or merely acute.

6. Leaves broadly linear (4–)5–8 cm wide; spathaceous bracts lanceolate, acute, 12–18 cm long, usually 5–6 cm broad at base; spikelets pedicelled, bracts obtuse, apiculate, maculate at apex. 3. *R. spectabilis*.

6. Leaves narrowly linear, 4 cm or less wide, spikelets sessile.

7. Leaves smooth, apparently not exceeding 3 cm wide; spathaceous bracts ca. 8–10 cm long, deeply cordate; spikelet bractlets conspicuously 5(–7)-nerved at apex, the outer obtuse and apiculate, the inner acute. 4. *R. pycnocephala*.

7. Leaves scabrous, 3–4(–5) cm wide; spathaceous bracts rounded or truncate, not cordate at base, usually 12–16 cm long; spikelet bractlets all obtuse, cucullate, more or less nerveless, yellow-tipped. 5. *R. scabra*.

2. Leaf-blades broadly linear or linear-lanceolate, abruptly constricted at the base, and above the summit of the leaf-sheath.

8. Leaf-blades lanceolate, cordate or abruptly contracted at the base, gradually acuminate at the apex, essentially sessile, i.e., without appreciable petiole surmounting the leaf-sheath, and extending below the base of the blade.

9. Bracteoles not at all gradate; heads elongate-hemispheric; leaf-blades smooth. 6. *R. ulei*.

9. Bracteoles evidently or strongly gradate; heads shallowly hemispheric; leaf-blades strongly glandular-papillate on the upper surface.

10. Cephalar bracts broadly deltoid-acuminate, nearly as long as wide; peduncles 7–9 cm long, 3–4 cm wide near apex, often reflexed at maturity; spike-

lets ca. 20 mm long (exclusive of sepals); bracteoles submembranous, not strongly gradate, the lower exceeding half the length of the spikelet, apex abruptly acuminate-pungent. 7. *R. steyermarkii.*

10. Cephalar bracts lanceolate, more than twice longer than wide, strongly cordate at base; peduncles 20–30 cm long, 2 cm or less wide near apex, erect; spikelets 16–17 mm long (exclusive of sepals); bracteoles glabrous, subindurated, strongly gradate, the lower much shorter than half the length of the spikelet, the upper long acuminate-pungent. 8. *R. fanshawei.*

8. Leaf-blades oblong, abruptly short-acuminate at the apex, abruptly constricted at the base into an evident petiole surmounting the leaf-sheath.

11. Bracteoles lanceolate, submembranous, weakly 3–5-nerved, conspicuously long-aristate; petiolar portion of the leaf 3 cm or less long; leaf-blades membranous. 9. *R. undulata.*

11. Bracteoles oblong, firm, strongly 3–7-nerved, abruptly short-acuminate; petiolar portion of the leaf 10–20 cm long; leaf-blades firm. 10. *R. muaju.*

1. Spikelets with bractlets more or less of equal length or not at all gradate, or if somewhat gradate, then the spike elongate.

12. Inflorescence with receptacle strongly elongate (sect. *Elongata*).

13. Receptacle 1.5–2.0 cm long, 6–9 mm broad; spathaceous bracts 15–25 cm long, 1.5–3.0 dm broad, cordate; inflorescence ovoid-spherical 3.0–3.5 cm wide, 3.5–4.0 cm long; leaf-blades 1.5–3.0 cm wide, with 14–16 inconspicuous nerves, orange-punctate. 11. *R. xiphoides.*

13. Receptacle 5–10 cm long.

14. Spathaceous bracts 20–30 cm long, 3.5–4.0 cm broad; outer bracteoles membranous, commonly equaling the length of the spikelet, conspicuously scarious-margined; leaf-blades firm, not at all rugose, 3–5 cm broad, with 10–12 conspicuous primary veins, minutely punctate (at × 20 mag.). 12. *R. elongata.*

14. Spathaceous bracts 20–25 cm long, 3.0–3.5 cm broad; outer bracteoles firm, considerably shorter than the spikelet, not conspicuously scarious-margined; leaf-blades 6–7 cm broad, membranous, conspicuously rugulose; hardly punctate, somewhat brown-pubescent beneath, with ca. 16 conspicuous primary veins. 13. *R. membranacea.*

12. Inflorescence with receptacle shallowly convex or at least hemispheric, bracteoles gradate, essentially of equal length (sect. *Longipes*).

15. Bracteoles oblanceolate, commonly submembranous, acute, merely apiculate, or if sometimes pungently acuminate, then the leaves with well developed petioles.

16. Leaves oblong-linear to lanceolate, blades terminating in an abrupt base, surmounted on a distinctly wingless petiole. 14. *R. longipes.*

16. Leaves narrowly linear-lanceolate, gradually passing into a winged petiole.

17. Leaves exceeding 1.5 cm wide; bracteoles 10–12 mm long. 15. *R. circasiana.*

17. Leaves less than 1 cm wide; bracteoles 5–6 mm long. 16. *R. angustifolia.*

15. Bracteoles acuminate, pungent or pungent-aristate; leaves without well developed petioles.

18. Leaf-blades strongly but minutely asperous-papillate; commonly 8 mm or less wide, width-length ratio 1:30–40; bracteoles narrowly lanceolate, 3-nerved, aristate. 17. *R. yapacana.*

18. Leaf-blades strongly glandular-punctate, commonly 1.5 cm or more wide, width-length ratio 1:10; bracteoles oblanceolate, nerveless, pungent-acuminate. 18. *R. spruceana.*

I. **Rapatea** sect. **Paludosa** Maguire, sect. nov.

Bracteis spiculis valde gradatis, receptaculis plano-convexis, non-elongatis.

1. **Rapatea paludosa** Aublet, Pl. Gui. Franc. **1**: 305. *pl. 118.* 1775.

1a. **Rapatea paludosa** var. **paludosa.**

Mnasium paludosum Willd., Spec. 2: 22. 1799.

Rapatea schultesiana Garcia-Barriga et Mora, Mutisia 22: 13. 1954. Type. *Garcia-Barriga 13987.* Rio Apaporis, Colombia (holotype COL; isotypes NY, US).

Type. Cayenne. *Aublet.*

Distribution. Herbs often of swampy places, widely distributed at low altitude in forest areas, eastern Colombia and Venezuela south to the states of Pará and Amazonas, Brazil.

Variable in leaf width and size of head, westerly the pungent acuminate tips of the bracteoles are measurably longer.

1b. Rapatea paludosa var. **sessiliflora** Maguire, Bull. Torrey Club **75**: 204. 1948.

Type. SURINAME. Tafelberg: *Maguire 24587* (holotype NY).

Distribution. Apparently localized in central Suriname in the vicinity of Tafelberg; Amazonian Brazil. Recognized by its smaller head, essentially sessile spikelets and narrow leaves. SURINAME. Vicinity Tafelberg: Coppename River headwaters, *Maguire 24177;* Tafelberg savanna landing strip, 25 Mar 1961, *Kramer et Hekking 3029* (NY). BRAZIL. Amazonas: In vicinibus Barra (Manaus), Prov. Río Negro, Dec–Mart 1850–51, *R. Spruce s.n.* (NY).

2. Rapatea linearis Gleason, Bull. Torrey Club **52**: 191. 1925.

Rapatea wettsteinii Suessenguth, Fedde Rep. Sp. Nov. **30**: 275. 1932. Type collections: Luetzelburg XI. 1928. Nos. *23766, 23768, 23831, & 23813.*

Distribution. Known in the Atlantic Guiana area only from the Northwest District, British Guiana, and apparently of general occurrence but nowhere common in the rain-forest region of Vaupés in Colombia. Probably of wider distribution. BRITISH GUIANA. Northwest District: *La Cruz 3913* (holotype NY); 4293. COLOMBIA. Vaupés: *Justica, Luetzelburg 23766, 23768, 23831 & 23813* (acc. Suessenguth); Río Inirída, *Fernandez 2167* (COL, NY); Río Paraná Pichuná, *Schultes & Cabrera 19911* (US).

Closely related to *Rapatea paludosa*, and particularly similar to *R. paludosa* var. *sessiliflora* but differing chiefly from specimens of this taxa by plane, 5-nerved, non-pungent lanceolate bracteole tips, which in var. *sessiliflora* are 3-nerved and abruptly pungent at the apex.

3. Rapatea spectabilis Pilg., Verk. Bot. Brand. **47**: 101. 1905.

Type. In Sümpfen bei Iquitos haufig, Bl. gelb, Juli, 1902, Dept. Loreto, Peru, *E. Ule 6251* (holotype B, photo NY; isotypes G, photo NY).

Distribution. Frequent in low-altitude swampy forest areas, in Choco and Amazonas, Colombia; Loreto, Peru.

4. Rapatea pycnocephala Seubert, Fl. Bras. **3**(1): 128. 1847.

Type. Brasilia tropica, Prov. Goyaz, *Gardner 3485* (isotype G, K (2 specimens, photo NY), P, photo NY).

Distribution. Occasional in marshy areas, cerrados, Mato Grosso, Minas Gerais, Goiás and Amazonas, Brazil.

5. Rapatea scabra Maguire, sp. nov. Fig. 13.

Herbae perennes, caudice brevi plus-minusve erecto; foliis distichis sigmoideis; vaginis equitantibus, conduplicatis, 15–20 cm longis, 1.5–2.0 cm latis, manifeste prominenter venis, scabris, marginibus conspicue scariis, apice aliquantum

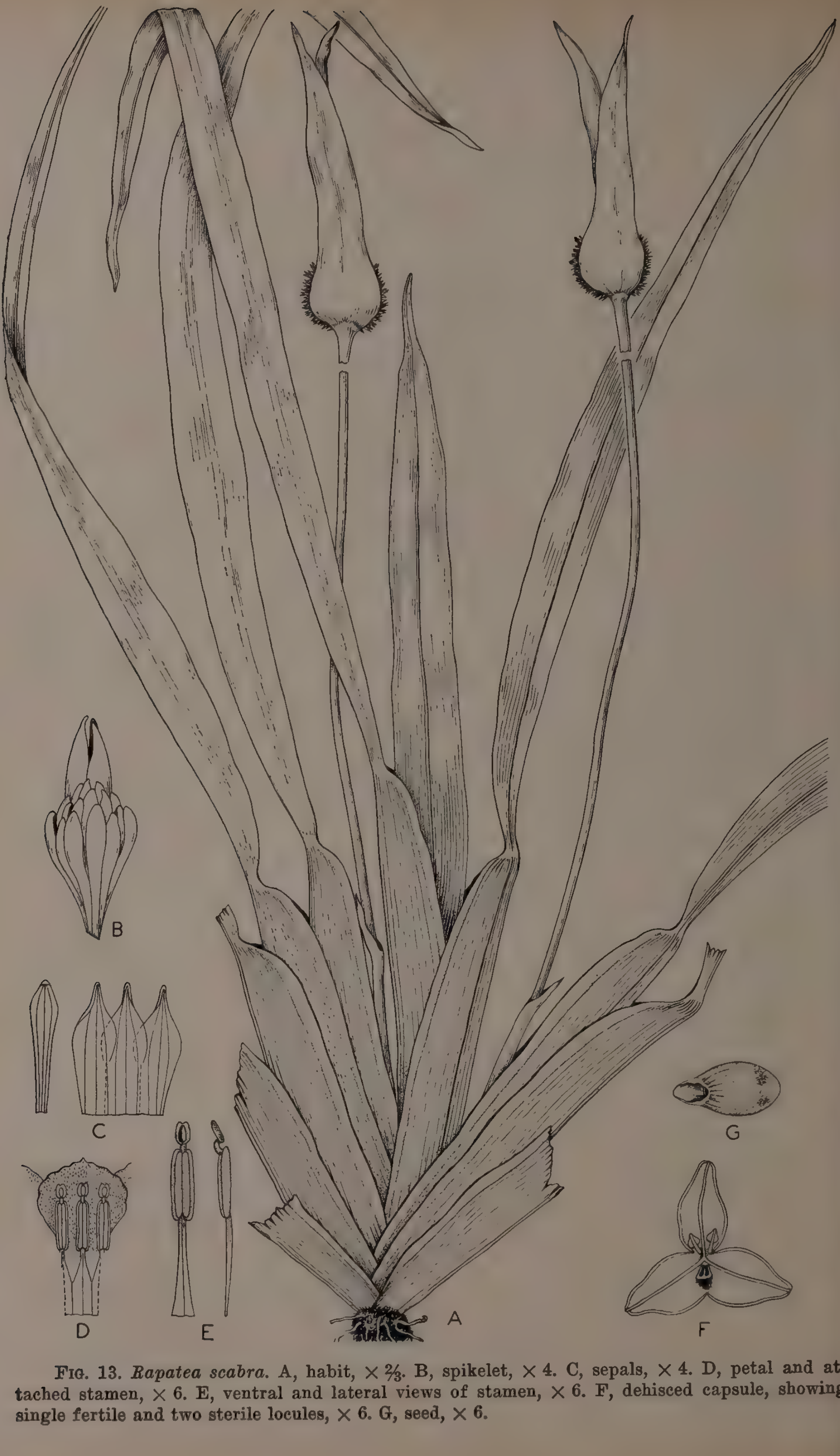

FIG. 13. *Rapatea scabra.* A, habit, × ⅔. B, spikelet, × 4. C, sepals, × 4. D, petal and attached stamen, × 6. E, ventral and lateral views of stamen, × 6. F, dehisced capsule, showing single fertile and two sterile locules, × 6. G, seed, × 6.

auriculato; laminis linearibus 5–15 dm longis, 2.0–3.5 cm latis, superficie superiore laeve, vix prominulis, inferiore scabro, 20–24 venis prominulis, apice abrupto lanceolato obliquo acumine enervato ferme 2–3 cm longo; pedunculis in foliis axillaribus, uno vel aliquot, 5–8 dm longis, gracilibus, 2–4 mm crassis, striatis a sulcatis, scabriusculis, amplificatis a 6–8 mm latis et aliquantum compressis apice; bracteis spathaceis 12–16 cm longis, 1.5–2.0 cm latis, non multus amplificatis basibus, inconspicue venis, scabris, apice acuto, aliquantum obliquo; receptaculo convexo, 8–10 mm lato, 2–5 mm alto, squamis paucis, paleaceis, anguste lanceolatis, 4–5 mm longis; spiculis sessilibus, axe crasso, ca. 3 mm longis; bracteolis ca. 30, gradatis et imbricatis, 6–8 mm longis, oblongis, obtusis, cucullatis, exterioribus apicibus latioribus, interioribus apicibus angustioribus; sepalis 3, in tubo 10 mm longo connatis, laminis subinduratis lanceolatis flavis 5–7 mm longis, in anthesis reflexis; petalis 3, unguibus, in tubo 2.5 mm longo connatis, laminis orbiculari-truncatis et retusis, flavis; staminibus 6, filamentis linearibus ca. 2 mm longis, 0.2 mm crassis, in basi tubo corolla insertis; antheris 4-lobis, ca. 4.5 mm longis, appendicibus cochleariformibus, oblongo-orbicularibus, 0.8–1.0 mm longis, brunneis; granis pollinis subsphaeroidalibus, axibus equatorialibus 35–50 μ longis, axibus polaribus 30–35 μ longis, aperturis zonisulcatis, sporodermis fine scorbiculatis, aperturis verrucosis; ovariis 3-locularibus, ad basim membraneis, loculis 1-ovulatis, placentis basilaribus; capsulis induratis, loculicidale dehiscentibus, valvis oblongo-lanceolatis, ovulis duobus abortivis; semine solitario elliptico-oblongo, 4–5 mm longo, testa hyaline conspicue striato.

Type. Terrestrial herb with linear scabrous leaves to 1.5 m long, peduncles 1-several, bracteoles of spikelets and sepals yellow, petals yellow, strongly dotted, frequent, moist places on granite, border of creek, Intermediate Camp at alt. 600 m, Cerro Sipapo, Terr. Amazonas, Venezuela, 27 Nov 1948, *Bassett Maguire & Louis Politi 27474* (holotype NY, isotypes BM, COL, F, GH, K, MB, NY, P, RB, VEN, US). Paratype. Same locality, 12 Feb 1949, *Maguire, Politi & Maguire 28722* (F, NY, VEN, US).

Distribution. Presently known only from the type locality.

The strongly marked *Rapatea scabra* obviously belongs to the sect. *Paludosa,* but is without known immediate relatives. The obtuse cucullate bracteoles occur otherwise nowhere in the genus.

6. **Rapatea ulei** Pilger, Notisbl. **6**: 119. 1914.

Type. In Sümpfen zwischen Flores und Tauruma, Manaos, Rio Negro [Amazonas, Brazil], blümend und fruchtend in März, 1912, *E. Ule 8822* (holotype B, photo NY; isotype RB).

Distribution. Known to me only by the type series cited above, and a second collection made in the type locality, viz., leaves to 3 ft long, in stream, dense forest at alt. 25 m, Manaos, 17 Oct 1929, *Killip & Smith 30183* (NY).

7. **Rapatea steyermarkii** Maguire, Fieldiana Bot. **28**: 130. 1951.

?*R. Friderici Augusti* Schomb., Die Rapatea Friderici Augusti und Saxo-Fridericia regalis, R. H. Schomburgk, Braunschweig, 1845.

Type. Shaded wet woods of a dwarf type, lower southeastern slopes of Carraotepuí, Bolívar, Venezuela, alt. 1675–1980 m, 5–6 Dec 1954, *Julian A. Steyermark 60868* (holotype F, photo NY; isotype NY).

Distribution. Marshy or swampy places on white sand, derived from Roraima sandstones. BRITISH GUIANA. Kamarang River Crossing, Kamarang Head, at alt. 2700 ft, *Maguire 33274*. VENEZUELA. Edo. Bolívar: Cerro Ilu-tepuí, on white sand at alt. 1200 m, 23 Mar 1952, *Maguire 33452;* Cerro Guaiquinima, on white sand at alt. 300 m, 19 Dec 1951, *Maguire 32741, 33109;* Chimantá-Massif, at alt. 415–700 m, 3 Apr 1953, *Steyermark 74803* (NY); Upper Cuyuni Basin, *Maguire, Steyermark & Maguire 46777, 46806, 46841.*

Rapatea Friderici Augusti Schomb. may well be the same as our *R. steyermarkii,* but so far as I am aware, none of Schomburgk's specimens are now extant, and his brief descriptions and drawings are not adequate for acceptable placement. The indefinite indication of locality, ''Wacht in dichten Waldungen des britischen Guiana,'' does not lend geographic support that an otherwise more definite geographical designation would have accomplished. Until more effective evidence is at hand, it is best to let the name *R. Friderici Augusti* rest as a *nomen ambiguum.*

8. **Rapatea fanshawei** Maguire, sp. nov. Fig. 14, H–M.

8a. **Rapatea fanshawei** var. **fanshawei.**

Herbae terrestres perennes 8–12(–15) dm altae; caudice brevi erecto; vaginis compressis aequalibus lanceolatis, 1.5–3.5 dm longis, 3–4 cm latis, conduplicatis; laminis papyraceis, lanceolatis vulgo 10–14 cm latis, 6–11 dm longis, falcate acuminatis, basi abrupte oblique constricta, petiolo deficiente; nervis primariis conspicuis vulgo 30–40, non-punctatis, ventrale sparse brunneo-puberulentis; pedunculis aliquot, 3–5 dm longis, valde compressis sursum, valde alatis, distale 2.0–2.5 cm latis, valde nervosis; capitulo oblique subreniformi, subcompresso semisphaerico; bracteis involucralibus 2 late lanceolatis, basim oblique reniformibus, 10–20 cm longis, 5–6 cm latis; receptaculo paleaceo, paleis triangularibus 2–5 mm longis; spiculis numerosis 14–17 mm longis, brevi pedicellatis; bracteolis valde gradatis 5–15 mm longis, subinduratis, apicem 3-nervis, brevipungentibus, apiculo 0.75–1.0 mm longo; corollis flavis; staminibus 6; granis pollinis subsphaeroideo-oblongis, axibus equatorialibus 30–33 μ, axibus polaribus ca. 45 μ longis; aperturis zonisulcatis; sporodermis equatorale conspicue scrobiculatis; ovariis 3-locularibus, loculis uni-ovulis, duobus sterilibus; capsulis induratis; semine solitario, oblongo, ca. 4.5 mm longo, 1.2 mm diam, striato.

Type. In moist woodland bordering Imbaimadai Savanna, alt. 550 m, Upper Mazaruni River, Pakaraima Mountains, British Guiana, 22 Oct 1951, *Bassett Maguire & D. B. Fanshawe 32192* (holotype NY). Paratypes. Pakaraima Mountains, British Guiana: Partang River, *Maguire & Tillett 43902, 43853; Tillett & Boyan 44862.*

Distribution. In woodland or woodland margins, on damp or wet white sand, the sandstone areas at median altitudes in the eastern and southern Pakaraima Mountains. BRITISH GUIANA. Karaurieng River, Mazaruni River, gallery woodland at alt. 1250 m, *Maguire & Fanshawe 32298;* locally abundant in *Micrandra* swamp 3 km N Chinowieng, Upper Mazaruni River, at alt. 1000 m, *Maguire, Bagshaw & Maguire 40566;* woodland vic. Chinowieng, *Maguire, Bagshaw & Maguire 40640;* woodland border Ando Savanna, alt. 800 m, Sukabi River, Ireng Rivier, *Maguire, Maguire & Wilson-Browne 46216.* VENEZUELA. Bolívar: Quebrada Tasita, Cerro Piton, at alt. 400 m. Río Chícanán, Río Cuyuni, *Maguire, Steyermark & Maguire 53617.*

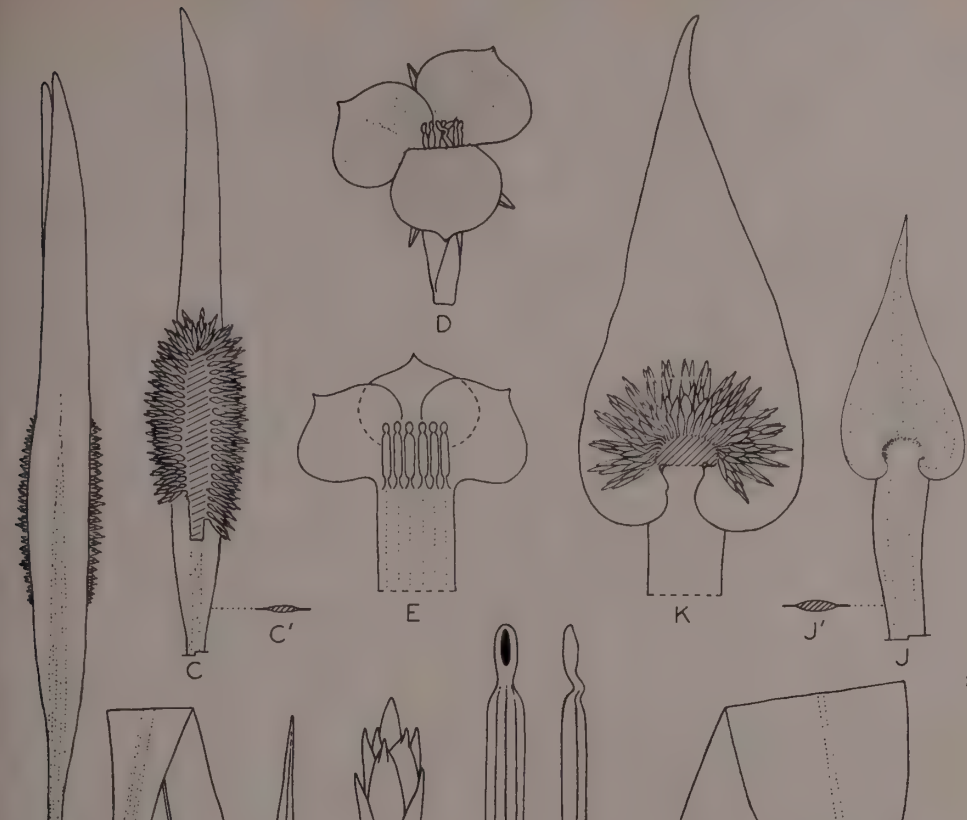

FIG. 14. *Rapatea membranacea* (A–G, *Maguire & Fanshawe 32365*). A, leaf, × ¼. B, inflorescence, × ¼. C, inflorescence sectioned lengthwise, × ¼. C′, cross-section of peduncle, × 1. D, spikelet and open flower, × 1. E, diagram of opened flower, × 1. F, spikelet, × 1. G, ventral and lateral view of anther, × 5. *Rapatea fanshawei* (H–M, *Maguire & Fanshawe 32193*). H, leaf, × ¼. J, immature inflorescence showing one of the paired subtending bracts, × ¼. J′, cross-section of peduncle, × 1. K, inflorescence sectioned lengthwise, × ¼. L, spikelet, × 2. M, ventral and lateral views of anthers, × 5.

8b. Rapatea fanshawei var. **minor** Maguire, var. nov.

Herbae diminutivae, 2.5–3.5 dm altae, aliter var. fanshawei similis.

Type. Locally abundant in bog-forest bordering Mokay-dai Savanna, alt. 490 m, Kukui River, Mazaruni River, British Guiana, 9 Sep 1960, *Stephen S. Tillett & Carolyn L. Tillett 45351* (holotype NY).

Known only from the type locality, but there developing a distinctive diminutive population consistently smaller in all features except the spikelets, which are equal to those of var. *fanshawei*. The larger more widespread variant was not noted in type area of the above.

9. Rapatea undulata Ducke, Archiv. Inst. Biol. Veg. Rio de Janeiro **2**: 28. 1935.

Type. Selvis loco alto, São Paulo de Olivenca, Rio Solimoes, Amazonas, Brazil, 10 Oct 1931, *A. Ducke 24179* (lectotype and isotype RB, isotype US).

Distribution. A very seldom collected but clearly marked species, evidently confined to forest areas of the Alto Amazonas in Brazil, Colombia, and probably Peru.

Additional specimen examined: Orosco, Selva, Trapecio, Amazonia, Colombia, *Schultes & Black 46–368* (NY).

10. Rapatea muaju Garcia-Barriga et Mora, Mutisia **22**: 7. 1954.

Type. Yerba erecta de flores blanco amarillentas, Jinogaje, entre los ríos Piraparana y Popeyaba, alt. 250 m, 3–11 Sep 1952, Río Apaporis, Vaupés, Colombia, *H. Garcia-Barriga 14372* (holotype COL, photo NY, isotypes NY, photo NY, US). Nombre vulgar: *Muaju* (en Makuna).

Distribution. Apparently locally restricted to the Apaporis River basin in Colombia between the Piraparana and Popeyaka rivers: Caño Ungija, Jino-Goje, alt. 250 m, 3–11 Sep 1952, *Garcia-Barriga 14364* (COL, NY); *14390* (COL). A clear-cut, distinctive species.

II. Rapatea sect. **Elongata** Maguire, sect. nov.

Receptaculis valde elongatis; bracteolis gradatis vel subapproximatis.

11. Rapatea xiphoides Sandwith, Kew Bull. **1939**: 23, *fig. 2*. 1939.

Type. In a running rivulet descending over rocky bushy ground from the savannah to the falls, Kaieteur Falls, Potaro River, British Guiana, 4 Sep 1937, *Sandwith 1337* (K, 2 sheets).

Distribution. I have seen otherwise only a topotype, *Maguire & Fanshawe 23297*.

12. Rapatea elongata G. K. Schultze, Notisblatt **12**: 230. 1934.

Type. Entre Tres Buritis e Jose Bonifacio, Mato Grosso, Brasilien, Juni, 1918, *F. G. Kuhlmann 1638* (isotype RB).

Distribution. BRAZIL. Mato Grosso: perennial herb to 2 m high, frequent in wet places, woodland along igarape 66 km W of Vilhena, *Maguire, Pires, Maguire & Silva 56536*. COLOMBIA. Valle: coastal Buenaventura, *Cuatrecasas 19752* (F, NY). Vaupés: Kananarí, *Schultes & Cabrera 13396* (NY), *14449* (NY); Río Piraparana, *Schultes & Cabrera 17125* (NY); Río Karuru, *Schultes & Cabrera 19192;* Río Paca, *Schultes & Cabrera 19549* (NY).

13. Rapatea membranacea Maguire, sp. nov. Fig. 14, A–G.

Herbae terrestres perennes vulgo 8–10 dm altae; caudice breve erecto; vaginis compressis equitantibus, aliquantum ventricosis, 20–25 cm longis, 5–6 cm latis conduplicatis; apice brevi-auriculatis, marginis anguste scariosis; laminis membranaceis, lineari-lanceolatis 6–10 dm longis, 5–8 cm latis, longiacuminatis, valde transverse rugulosis; nervis primariis 10–14 prominentibus; pedunculis aliquot, 3–4 dm longis, valde nervatis vel subcostatis, compressis subalatis, 8–10 mm latis; capitulo oblongo, 6–12 cm longo, vulgo 4–5 cm diam; bracteis involucralibus 2, anguste lanceolatis 20–30 cm longis, 3.0–4.5 cm latis, acute attenuatis, mediis axibus capitulis adnatis, basibus 4–8 cm in pedunculo decurrentibus; receptaculo paleaceo, paleis 4–7 mm longis, scariosis, anguste lanceolatis; spiculis numerosis, radiatis, simpliciter vel pauci aggregate dispositis, pedicellis 1–3 mm longis; bracteolis ca. 10, essentialiter non-gradatis, maioribus submembranaceis, lanceolatis, 8–14 mm longis, distale debiliter 3-nervis, apice subrigido, pungenti-acuminato; petalis 3, unguiculatis, unguibus 10–12 mm longis, hyalinis, laterale connatis, laminis rotundo-obovatis, vulgo breviapiculatis, multivenis, in vivo flavo; staminibus 6, tubo corolla adnatis, filamentis 1.5 mm longis; antheris ca. 6 mm longis, 4-locularibus, appendicibus cochleariformibus, brevistipitatis, ca. 1.5 mm longis; granis pollinis subsphaeroidalibus, axibus equatorialibus 30–35 μ longis, axibus polaribus 43–49 μ longis, aperturis zonisulcatis, sporodermis minute scorbiculatis, verrucosis aperturarum elongatis; ovariis 3-locularibus, loculis uniovulatis, ovulis basilaribus, capsulis induratis, loculicidalibus; semine solitario oblongo ca. 5 mm longo, 1.75 mm diam, biapiculato.

Type. Clumped perennial herb of marshy places by streams or in depressions in *Cunuria* forest, leaves rugose, flowers yellow, fruit head oblong-squarish, abundant, Membaru-Kurupung Trail, alt. 750 m, Pakaraima Mountains, British Guiana, 30 Oct 1951, *Bassett Maguire & D. B. Fanshawe 32365* (holotype NY). Paratypes. Herb to 1 m, leaves rugose, flowers yellow, visited by small bee; herbage extremely mucilaginous, common in marshy areas along ridge trail, upper Partang River, alt. 700 m, affluent Mazaruni River, Pakaraima Mountains, British Guiana, *Tillett, Tillett & Boyan 43972;* Partang River at alt. 824 m, *Tillett, Tillett & Boyan 44865.*

Distribution. Known only from swampy forested areas in the northeastern Pakaraima Mountains, British Guiana, at median altitudes of 700–1000 m.

III. **Rapatea** sect. **Longipes** Maguire, sect. nov.

Bracteolis gradatis; receptaculis convexis vel hemisphaericis.

Section *Longipes* is an assemblage of five plastic or genetically unstable entities. More material than is now available is necessary for a resolution of the taxonomic relation among them. Population studies in the field, cytologic investigation, and perhaps genetic study all combined may be necessary to resolve the existing biologic reality.

14. Rapatea longipes Spruce ex Körnicke, Linnaea **37**: 472. 1872.

Key to the Varieties of *Rapatea longipes*

1. Leaf-sheaths lanceolate, 3 or more times longer than broad; heads relatively small, 1–2 cm broad; leaf-blades lanceolate. var. *longipes.*
1. Leaf-sheaths strongly ventricose, 2–3 times longer than broad; heads relatively large, 2.5 cm broad; leaf-blades oblong, 3.5–5.0 × 9.0–15.0 cm. var. *modesta.*

14a. Rapatea longipes var. **longipes.**

Type. Prope Panure, ad Rio Vaupés, Amazonas, Brazil, Oct 1852–Jan 1853, *R. Spruce 2646* (isotype NY).

Distribution. Inundable or wet sandy areas, largely in the drainages of the Río Vaupés and Guainía. BRAZIL. Amazonas: Ipanore, Rio Vaupés, *Schultes & Pires 9079* (COL, NY); Yutica, Rio Vaupés, *Romero 3530* (COL, NY); Rio Içana, *Black 48–2708* (NY); Jucabí, Rio Negro, *Schultes & Lopés 9632* (NY); Inambú, *Romero 3579* (COL); Foz Rio Caiarí, Rio Negro, *Fróes & Addison 28601* (NY). COLOMBIA. Vaupés: Mitú, Río Vaupés, *Schultes & Cabrera 19356* (NY); Río Paca, *Schultes & Cabrera 19550* (NY); Río Macú-Paraná, *Allen 3044* (COL). VENEZUELA. Amazonas: on white sand, sabanita, Maroa, *Maguire, Wurdack & Keith 41727.*

14b. Rapatea longipes var. **modesta** (Maguire) Maguire, comb. nov.

Rapatea modesta Maguire, Bot. Mus. Leafl. Harvard Univ. 14: 112. 1950.

Type. In sandy savanna, bracts and flowers white, interior regions of Trapecio between Amazon and Putumayo watersheds, alt. about 100 m, Amazonas, Colombia, Nov 1945, *R. E. Schultes 6900* (holotype NY).

Distribution. COLOMBIA. Amazonas: Trapecio between Amazon and Putumayo watersheds, Oct 1945, *Schultes 6899* (COL); without definite locality, *Schultes & Black 46–361* (NY).

Intermediate to var. *longipes* is: Río Piraparana, Río Apaporis, Vaupés, Colombia, *Schultes & Cabrera 17500.*

From the few specimens collected, the var. *modesta* seems to occupy the Putumayo watershed and thus is geographically distinct from the var. *longipes* which occupies the more northern and eastern Vaupés and Río Negro-Guainía watersheds.

15. Rapatea circasiana Garcia-Barriga & Mora, Mutisia **22**: 9. 1954.

Type. Yerba pequena, flores amarillas, bracteas muy largas, en la base ferrugineas, Cerro de Circasia, entre el Río Tu y Numu, alt. 380–450 m, 30 Oct 1952, Río Vaupés, Vaupés, Colombia, *H. Garcia-Barriga 15020* (holotype COL, isotype NY).

Distribution. Low altitude sandy savannas, drainages of Rio Vaupés, Colombia, Amazonas, Brazil, and Ríos Atabapo and Orinoco, Amazonas, Venezuela. BRAZIL. Amazonas: Baixo Vaupés, *Ducke 24176* (RB). COLOMBIA. Vaupés: Río Kananarí, *Schultes & Cabrera 14407* (NY); Río Vaupés, Circasia, *Schultes & Cabrera 19680* (NY); Sabana Cacagual, Río Atabapo, unicate in forest, *Maguire & Wurdack 41445.* VENEZUELA. Amazonas: Yavita, Río Atabapo, *Williams 14037* (F, photo distributed as *R. sphaeroidea* Maguire, ined.), *Williams 14066* (F); Sabana Cumare, Río Atabapo, *Wurdack & Adderley 42762;* the following collections show an intermediacy to perhaps an intergression with *R. sprucei:* Limoncito, Caño Miguel, Río Guainía, *Maguire, Wurdack & Keith 41908; Wurdack & Adderley 43235;* Santa Cruz, Río Atabapo, *Foldats 3809* (NY); Esmeralda, Río Orinoco, *Steyermark 57822* (NY).

16. Rapatea angustifolia Spruce ex Körnicke, Linnaea **37**: 469. 1872.

Type. Ad flumina Casiquiari, Vasiva et Pacimoni (Amazonas, Venezuela), *R. Spruce 3046* (K, photo NY; isotypes GH, NY, US, fragment F).

Distribution. Savanna marsh or streamside plants, known certainly only from the Río Guainía region of Venezuela. VENEZUELA. Amazonas: Río Pacimoni, Casiquiare, *Maguire, Wurdack & Bunting 36646;* La Ceiba, Caño San Miguel, Río Guainía, *Maguire, Wurdack & Keith 41911.*

The original collection, *Spruce 3046* consists only of diminutive specimens that may be depauperate or immature. The larger body of material, under the name of *Rapatea circasiana,* may indeed represent a more prevalent expression of the same species. At this time no satisfactory resolution can be made as to the degree of intimacy between the two.

17. Rapatea yapacana Maguire, sp. nov.

A *R. angustifolia* Spruce ex Körnicke et *R. circasiana* Garcia-Barriga et Mora valde affinis, sed differt bracteolis longi-aristatis.

Herbae terrestres perennes vulgo 3–4 dm altae; vaginis compressis, anguste lanceolatis, 6–8 cm longis; laminis anguste linearibus 3–6(–8) mm latis, 2.5–3.5 dm longis, acutiusculis, valde minuteque aspero-papillatis; pedunculis vulgo 3–4 dm longis; capitulo subhemisphaerico, bracteis involucralibus 2, 3.0–4.5 cm longis, lanceolatis, basibus 1.2–1.6 cm latis; bracteolis non-gradatis, anguste lanceolatis, 10–14 mm longis, 3-nervis, longi-aristatis, arista 2–4 mm longa; granis pollinis subsphaeroidalibus, axibus equatorialibus 35–37.5 μ, axibus polaribus 30–32.5 μ, aperturis zonisulcatis, sporodermis minute scorbiculatis, aperturis verruculatis; seminibus mihi ignotis.

Type. Hummock-forming perennial in open woodland, frequent, Yapacana Savanna 3, Orinoco River, alt. 125 m, Amazonas, Venezuela, 20 Nov 1953, *Bassett Maguire, John J. Wurdack & George S. Bunting 36584-A* (holotype NY). Paratypes. All Yapacana Savanna 3: *Maguire, Cowan & Wurdack 30489-A; Maguire, Wurdack & Bunting 36574; Maguire, Wurdack & Maguire 41540.*

In the isolated Yapacana Savannas, *R. yapacana* is common, and the population so developed is of a highly uniform nature.

18. Rapatea spruceana Körnicke, Linnaea **37**: 470. 1872.

Type. Ad flum. Guainia, Rio Negro supra ostium fluminis Casiquiare, in 1854, *R. Spruce 3752* (isotype K 2, NY).

Distribution. Plants usually of marshy or wet sandy places of the Río Negro drainage. COLOMBIA. Vaupés, Río Negro: vic. Piedra de Cocui, *Schultes & Lopez 9505* (NY); San Felipe, *Schultes & Lopez 9297* (NY), *Schultes, Baker & Cabrera 17988* (NY); Río Guainía, Puerto Colombia, *Schultes, Baker & Cabrera 18179* (NY), *Maguire & Wurdack 41848.* VENEZUELA. Amazonas, Río Guainía: sabanita vic. Maroa, *Maguire, Wurdack & Keith 41756, 41728; Maguire & Wurdack 45720;* Sabana El Venado, Caño Pimichín, *Maguire & Wurdack 36364.*

A plastic species, the following from Maroa being intermediate to *Rapatea longipes: Maguire & Wurdack 35692.*

Excluded Names and Species

Rapatea flava Kunth, Enum. Pl. **3**: 367. 1820. = **Duckea flava** (Link) Maguire.

Rapatea friderici-augusti Rob. Schomb., Rapatea Frid. Aug. Saxo-Frid. Reg. **14**. 1845. = nomen ambiguum.

Rapatea pandanoides Linden & Andre, Ill. Hort. **20**: 213. *pl. 153, 154.* 1873. = **Saxofridericia subcordata** Körnicke.

Rapatea gracilis Poepp. & Endl., Nov. Gen. & Sp. **2**: 51. *pl. 168.* 1838. = **Cephalostemon gracilis** (P. & E.) Rob. Schomb., Rapatea Frid. Aug. Saxo-Frid. Reg. 14. 1845.

LAURACEAE [25]

Aiouea pernitida C. K. Allen, sp. nov. Fig. 15.

Arbor ad 20 m alta, gemmis anguste ovoideis, acuminatis, ramulis glabris, juventute gracilibus pallide rubescentibus aliquantum angularibus, mox teretibus, striatis. Folia alternata, ramulorum apice saepe opposita congesta, petiolis gracilibus rubescentibus, canaliculatis, ad 10–12 mm longis, laminis utrinque glabris coriaceis supra flavo-viridescentibus pernitidis, subtus pallidioribus opacis, ellipticis ad basim attenuate acutis, leviter decurrentibus, (6–)8–10 cm longis et 2–3.5 cm latis, graciliter acuminatis vel obtuse acutis, raro emarginatis, utrinque undulatis, penninerviis, costa supra rubescenti leviter elevata, subtus conspicue elevata, nervis 6–8-paribus supra aliquando rubescentibus plerumque leviter inconspicueque elevatis, subtus gracilibus plus minusve obscuris elevatis, angulo ad 34° divergentibus, supra leviter elevato subtus obscuro. Inflorescentia axillaris subterminalisque gloriose multiflora, pallide rubescenti, satis tenuis, utrinque glabra, paniculata, ad 6–8 cm longa, pedunculo ad 3–5 cm longo. Flores parvi ad 3.5 mm longi, pedicellis filamentosis ad 1.5–4.5 mm longis, perianthio suburceolato-campanulato, aliquantum rigido (post anthesin), lobis ovatis ad apicem plus minusve papillosis, venis conspicuis, ad 1–1.6 mm longis, tubo ad 1–2 mm longo; staminibus fertilibus ser I ut videtur subpetalloideis ad 0.9–1.3 mm longis, antheris rectangularibus abrupte acuminatis, locellis basalibus, connectivo magno, filamentis brevibus plus minusve robustis quam antheris quartam vel tertiam partem brevioribus, ser II et III sterilibus, ser II plus minusve variabile subpetalloideis ad 1 mm longis, ser III filamentis aliquantum robustis quam antheris subrotundatis leviter longioribus biglandulosis, glandulis magnis ad 0.4–0.6 mm stipitatis; ser IV subcordato-ovatis acuminatis tenue brevique stipitatis, ad 0.8 mm longis; gynoecio ad 1.5–2 mm longo, ovario subrotundo, ad 0.9 mm diam., stylo crasso ad 0.8–10 mm longo, ad stigmata plus minusve lobata expanso. Infructescentia et fructus ignoti.

Type. Arbor de 20 metros de alto, hojas verdes brillantes, paniculas de flores vistosas, selvas pluviales, Río Blanco, pequeño afluente del Río Icabarú, Bolívar, Venezuela, 16 Abril 1957, *A. L. Bernardi 6591* (holotype, fl. NY).

The species is striking because of the showy, densely flowered inflorescences borne in the axils of the very shining, undulate leaves which are thickly clustered at the tips of the terminal branchlets. There are species of which the above is superficially reminiscent, among them *A. benthamiana* and *A. guianensis*, both of which bear larger leaves, less densely congested at the branchlet tips and more tenuous inflorescences with smaller, more dainty flowers quite different in structure.

The floral structure of *A. pernitida* is similar to that of *Aiouea myristicoides* Mez belonging to the subgenus *Trianthera* Mez, with but one staminal cycle fer-

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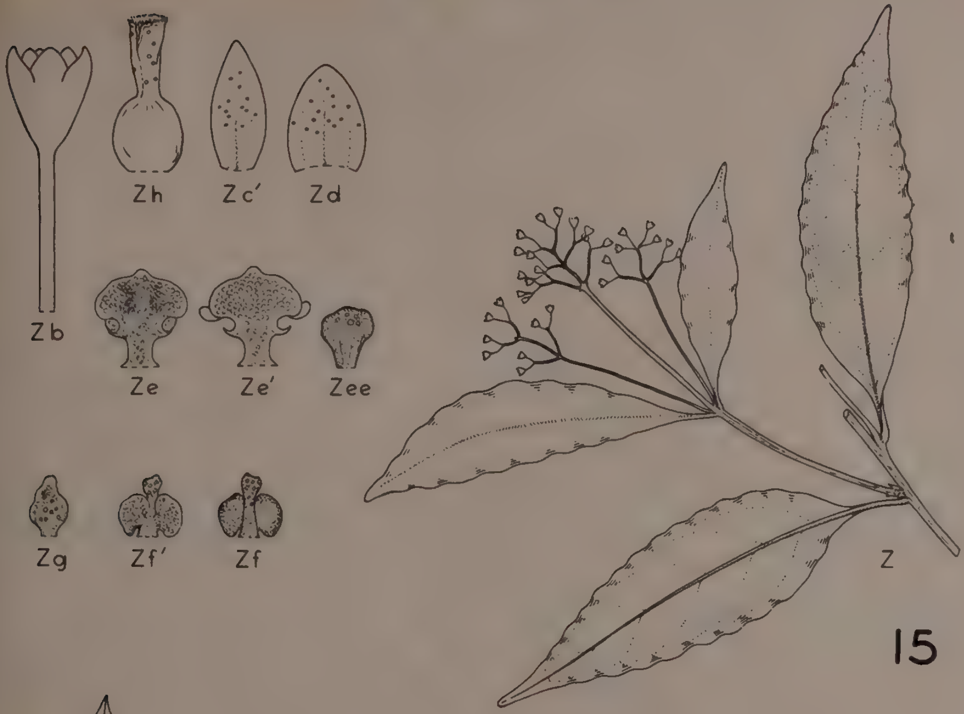
[25] By Caroline K. Allen.



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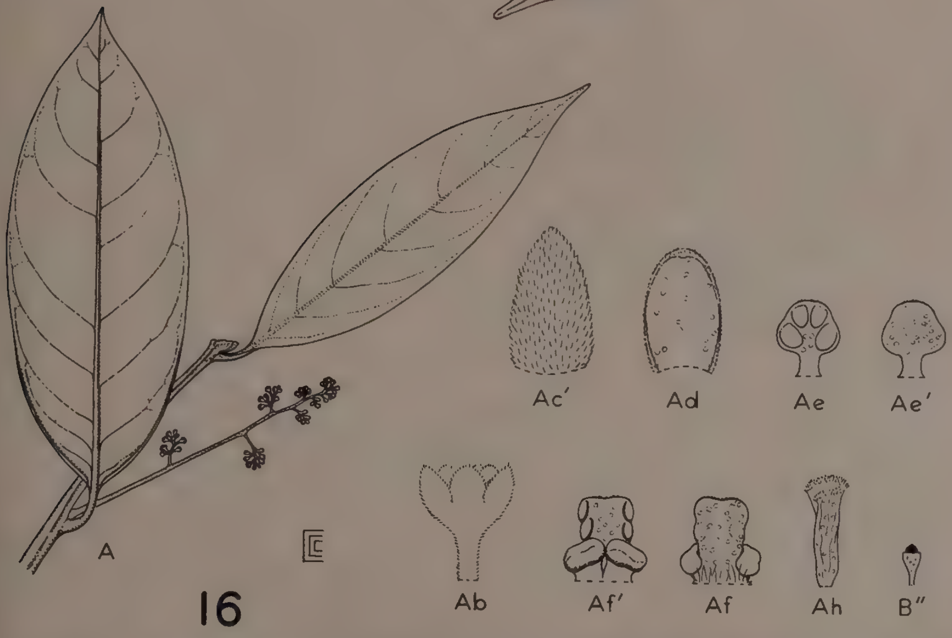

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FIG. 15. *Aiouea pernitida* (Z–Zh, *Bernardi 6591*). Z, habit, flowering branchlet, × 0.5. Zb, flower, × 5. Zc′, tepal, ser I, dorsal, × 10. Zd, tepal, ser II, ventral, × 10. Ze, stamen, ser I, ventral, × 10. Ze′, stamen, ser I, dorsal, × 10. Zee, stamen, ser II, ventral, × 10, Zf, stamen, ser III, ventral, × 10. Zf′, stamen, ser III, dorsal, × 10. Zg, staminodium, ser IV, ventral, × 10. Zh, ovary, × 10. FIG. 16. *Ocotea duotincta* (A–Ah, *Steyermark, G. C. K. & E. Dunsterville 92880* ♂; B″, *Maguire, Steyermark & Maguire 53638*). A, habit, flowering branchlet, × 0.5, Ab, flower, × 5. Ac′, tepal, ser I, dorsal, × 10. Ad, tepal, ser II, ventral, × 10. Ae, stamen, ser I & II, ventral, × 10. Ae′, stamen, ser I & II, dorsal, × 10. Af, stamen, ser III, ventral, × 10. Af′, stamen, ser III, dorsal, × 10. Ah, aborted ovary, × 10. B″, fruit, × 0.5.

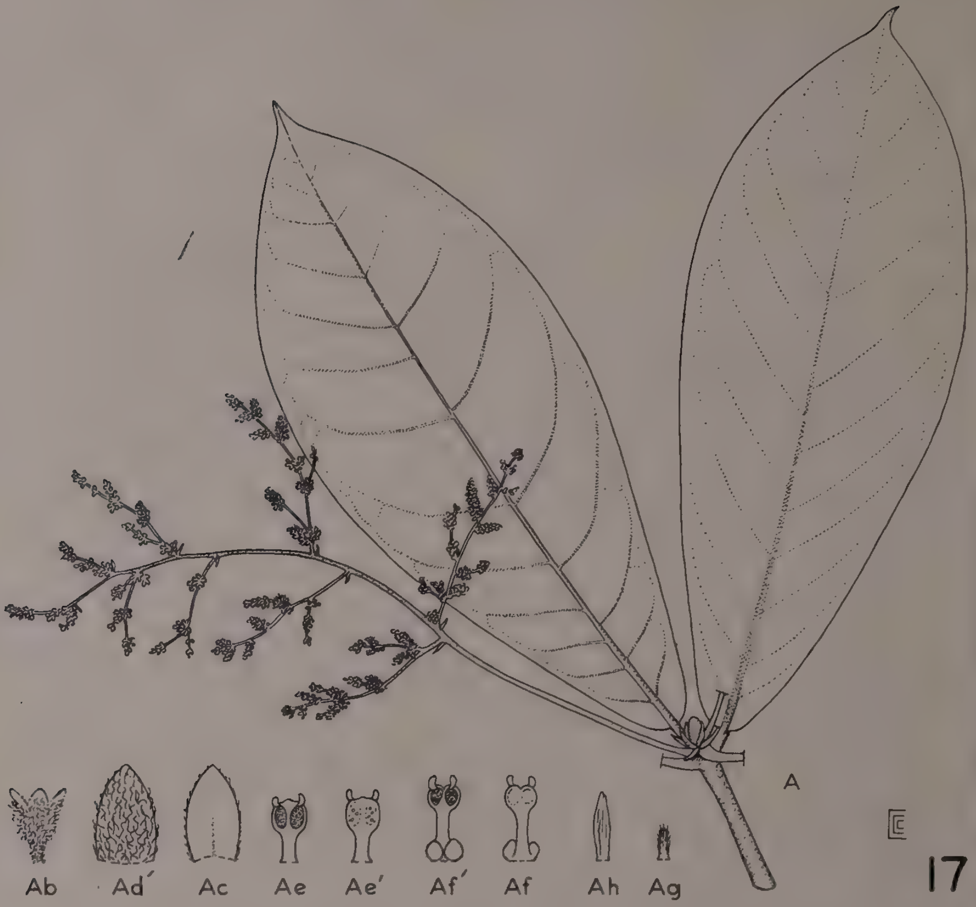

FIG. 17. *Endlicheria dictifarinosa* (*Steyermark 90535* ♂). A, habit, flowering branchlet, × 0.5. Ab, flower, × 5. Ac, tepal, ser I, ventral, × 10. Ad′, tepal, ser II, dorsal, × 10. Ae, stamen, ser I & II, ventral, × 10. Ae′, stamen, ser I & II, dorsal, × 10. Af, stamen, ser III, ventral, × 10. Af′, stamen, ser III, dorsal, × 10. Ag, staminodium, ser IV, × 10. Ah, aborted ovary, × 10.

tile; it is similar in structure, as Kostermans (Meded. Bot. Mus. Utrecht **46**: 103. 1938) suggests in connection with *A. myristicoides*, to *A. piauhyensis* (Meissner) Mez belonging to the subgenus *Hufelandiopsis* Mez, with the first three cycles of stamens fertile.

The species of this group appear to be unstable for, although in general the floral structures are as outlined above, they are by no means consistently so. Petalloidy is variable in its manifestation, the stamens ranging from narrowly to broadly expanded or club-shaped at the tip.

Licaria schultesii C. K. Allen, sp. nov. Fig. 18.

Arbor parva, gemmis anguste lanceolato-ellipsoideis attenuato-acuminatis atro-rubescentibus fulvo-pubescentibus, ramulis atro-rubescentibus sulcatis (vel angulatis) glabrescentibus. Folia alternata, saepe ad apicem ramulorum congesta, petiolis satis gracilibus ut videtur perlongis, ad 5 cm, canaliculatis, sed,

laminis ad 1.5–3 cm decurrentibus petiolis simulantibus, minute striatis atro-rubescentibus, sparse pubescentibus mox glabris, laminis coriaceis supra glabrescentibus minute floccoso-fulvo-pubescentibus, plus minusve nitidis in sicco aliquantum brunnescentibus subtus pallide brunneis, lanceolatis ellipticisve, 15–24 cm longis et 5–7(–9) cm latis, ad basim acutis ad apicem acute acuminatis, acumine ad 10(–15) mm longo, penninerviis, costa supra conspicue elevata brunnea, subtus perconspicue elevata atro-rubescente sparse pubescente, nerviis 10–12-paribus, supra graciliter subtus crasse elevata ad marginem 10 mm confluentibus ad angulo 55–50° divergentibus, rete venularum utrinque minute obscuro. Inflorescentia subterminalis, atro-rubescentia, racemoso-paniculata, 10–12 cm longa, pedunculo satis robusto, 6–7 cm longo. Flores ad 3.5–4 mm longi, pedicello satis gracili ad 1.5 mm longo, perianthio campanulato flavo ad marginem hyalino, margine ciliolato, tubo plus minusve 1 mm; staminibus ser I & II staminoidalibus variabilibus squamelliformibus, antheris sterilibus, manifeste bicorniculatis, ad 1 mm longis, ser III fertilibus ad 1.3–1.7 mm longis antheris subovatis vel saepe ad inclinatis bicorniculatis simulantibus, filamentis satis crassis ad basim biglandulosis, glandulis magnis ad 0.7 mm longis, brevistipulatis subaequantibus, ser IV 0; gynoecio tenui ad 1.5–2.5 mm longo glabro, ovario ellipsoideo stylo tenui 1.2 subaequanti, stigmate inconspicue subtriangulari. Infructescentia et fructus ignoti.

Type. Small tree, flowers yellow, at base of Serra Tukano, above Trovão, Rio Vaupés, between Ipanoré and confluence with Rio Negro, Amazonas, Brazil, 7 Nov 1947, *Richard Evans Schultes & João Murça Pires 9004* (holotype, fl. NY, isotype, IAN).

Distribution. A small tree with yellow flowers distinctive for its lanceolate or elliptic leaves with the blades narrowly decurrent for as long as 3 cm, thus simulating a slender petiole up to 5 cm in length, occurring in caatingas. BRAZIL. Amazonas: caatinga próxima à Serra dos Tucanos, Rio Uaupés, *Pires 871* (fl. IAN), caatinga próxima à Serra Taraquá, Rio Uaupés, *987* (fl. IAN).

The species is similar to *Licaria pachycarpum,* differing in the uniformly coriaceous lanceolate to elliptic leaves with bases broadly acute and tips sharply acuminate; the lateral nerves more numerous and more deeply impressed above, their confluence near the margin making a regular pattern; the inflorescences always subterminal, bearing flowers with the two outer series of sterile stamens having in place of the anthers a short, flabelliform expanded tissue that is often distinctly bicorniculate; the third cycle shows anthers that are fertile, also of this shape, with large discrete glands at the base of the robust filament, of the more usual type, being subcordate and stoutly stipiate. These characteristics serve to separate the new species from already described taxa.

The above entity is named for Dr. Richard Evans Schultes who has collected much in Colombia and adjoining areas and added greatly to our knowledge of the floras involved.

Endlicheria anomala Nees ex Meissner in D. C. Prodr. **15**(1): 173. 1864. Kostermans, Rec. Trav. Bot. Néerl. **34**: 508. 1937; Meded. Bot. Mus. Utrecht **42**: 508. 1937.

Goeppertia anomala Nees, Syst. Laurin. 370. 1836.

Type. "Circa Ega ad flum. Amazonum, Brasil. m. Sept. 1831," *E. Poeppig 2552* (isotype, ♂ fl. NY).

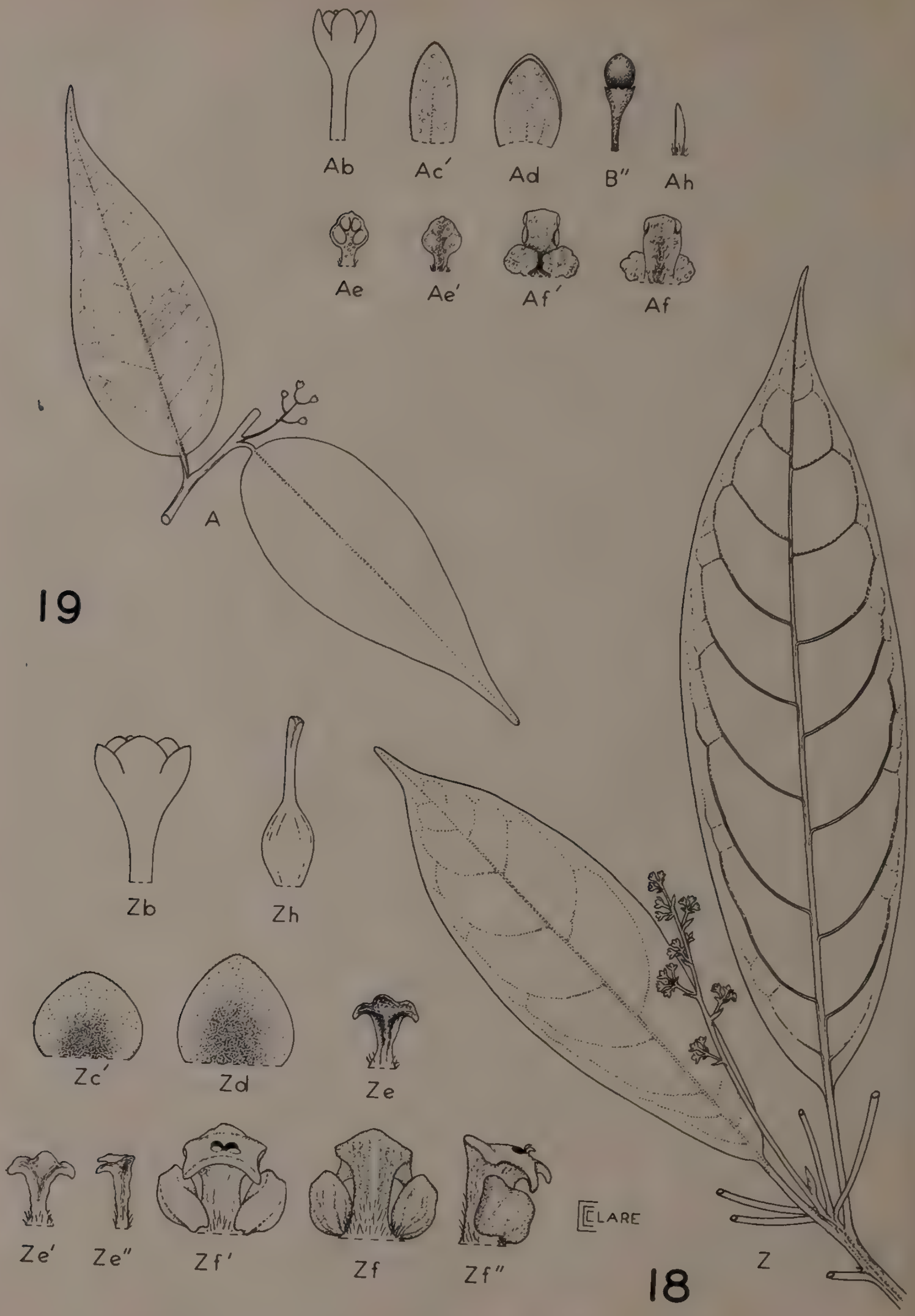
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FIG. 18. *Licaria schultesii* (Z–Zh, *Schultes & Pires 9004*). Z, habit, flowering branchlet, × 0.5. Zb, flower, × 5. Zc′, tepal, ser I, dorsal, × 10. Zd, tepal, ser I, ventral, × 10. Ze, stamen, ser I & II, ventral, × 10. Ze′, stamen, ser I & II, dorsal, × 10. Ze″, stamen, ser I & II, lateral, × 10. Zf, stamen, ser III, ventral, × 10. Zf′, stamen, ser III, dorsal, × 10. Zf″, stamen, ser III, lateral, × 10. Zh, ovary, × 10. FIG. 19. *Ocotea depauperata* (A, *Steyermark 90261A;* Ab–B″,

Distribution. A usually small tree with alternate chartaceous leaves, reticulate above, beneath fulvous to pale ferrugineous sericeous, in the dried state, with striking axillary panicles often densely flowered, occurring generally throughout the tropics in the northern part of South America. BRAZIL. Amazonas: Camatian, border of creek, varzea land, *Froes 23966* (y.fr. IAN, NY), beira do Rio Refe, igapo, *26126* (fr. IAN). COLOMBIA. Amazonas: beira do Río Loreto-Yaco, varzea, *Black & Schultes 46–289* (fr. IAN, US); on flat mud bank of Río Popeyacá (tributary of Apaporis, between Río Piraparaná and Raudal Yayacopi) near mouth, *Schultes & Cabrera 15566* (y.fr. NY, US); Amazonas-Vaupés: Río Apaporis, flood-bank, entre el Río Pacoa y el Río Kananarí, Soratama, *12664* (fr. NY, US), mouth of Pacoa, *13067* (♂ fl. NY), *13073* (fr. NY, US), *13076* (fl. NY), Soratama, *13236* (fl. NY), *13241* (♂ fl. NY); Caño Oo-gö'-dja, Jinogojé, *17033* (♂ fl. NY); Vaupés: Río Kuduyarí (tributary of Río Vaupés, middle and lower course, *17898* (abnormal fl. NY), US); Río Guainía Basin, Río Naquieni, vicinity of Cerro Monachí, *Schultes & Lopez 10052* (fr. NY).

Since the study of Mez, this well-named species has been the repository of collections of *Endlicheria* occurring in the Amazon drainage area and its periphery, which exhibit floral instability, notable particularly in the staminal cycles, the third of which usually has 4-celled anthers, the larger lower pair introrse, the upper small (or even absent) extrorse. The lower leaf surface is predominantly characterized by a golden or fulvous sericeous pubescence. The fruiting material, heretofore rarely collected, has been for the most part in a very young stage of development, the ellipsoid or oblong-ellipsoid fruit subtended by a flat disklike structure showing the minute, truncate remains of the tepals.

The numbers cited above agree well with the type, Poeppig 2552 (*Goeppertia polyantha*) which is a staminate specimen. *Goeppertia polyantha*, a synonym according to Mez and later Kostermans, based on Spruce 1648 and Spruce "Nectandra (6)" probably 1433, both staminate specimens from the vicinity of Barra in the Province of Rio Negro, and Spruce 874 from British Guiana.

Spruce 1648 accords closely with Poeppig 2552; the other two syntypes differ from the latter in the character of the pubescence on the lower leaf surface which is distinctly tomentose. Later collections of young fruiting material, made along the Rio Negro in the Amazon Basin, show also a persistent tomentum more or less olive-drab in the dried state instead of the characteristic often colorful sericeous pubescence. It is not feasible at present to predict from the young fruit available the characteristics of the mature fruit and its subtending cupule.

The most closely related entity is *Ocotea simulans* Allen (Mem. N. Y. Bot. Gard. **10**(5): 99. 1964) described from Amazonas, Venezuela principally along the Orinoco and Casiquiare rivers and their tributaries in the Guayana area and extending westward into the Vaupés basin. Obviously, the latter taxa belongs to the general *anomala*-complex. In some of the flowering material there is a deviation from the *Endlicheria* flower-type in a different manner, 4-celled anthers appearing in the three outer cycles; the fruiting material cited is identical with that of *E. anomala,* as well as the pubescence on the lower leaf surface. This, coupled with the disk, a type often subtending the fruit of members of the genus

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Steyermark 90270 ♂). A, habit, flowering branchlet, × 0.5. Ab, flower, × 5. Ac′, tepal, ser I, dorsal, × 10. Ad, tepal, ser I, ventral, × 10. Ae, stamen, ser I & II, ventral, × 10. Ae′, stamen, ser I & II, dorsal, × 10. Af, stamen, ser III, ventral, × 10. Af′, stamen, ser III, dorsal, × 10. Ah, aborted ovary, × 10. B″, fruit, × 0.5.

Ocotea, instead of the subhemispherical cupule typically found enveloping the base of *Endlicheria* fruits, was the basis for the new *Ocotea* species.

Until mature fruiting collections are available which are beyond doubt conspecific with the Schomburgk and Spruce [Nectandra (6), "1433"] specimens, the status quo of the two described species will be maintained.

Endlicheria cocuirey Kostermans, Rec. Trav. Bot. Néerl. **34**: 522. 1937; Meded. Bot. Mus. Utrecht **42**: 522. 1937. Allen, Mem. N. Y. Bot. Gard. **10**(5): 59. 1964.

Additional Distribution. VENEZUELA. Bolívar: Alto Río Cuyuni, Río Uiriyuk, frequent, drooping riverine tree, *Maguire, Steyermark & Maguire 46713* (fl. NY).

Endlicheria dictifarinosa C. K. Allen, sp. nov. Fig. 17.

Arbor ad 10 m alta, gemmis plus minusve ellipsoideis dense canescenti-tomentosis, ramulis pallide ferrugineo-tomentosis teretibus. Folia verticillata, petiolis brevissimis ad 5–6 mm longis robustis canescenti-tomentosis ad basim expansis ad 3–4 mm latis, laminis subcoriaceis, griseo-viridibus, supra sparsissime strigosis minute papillosis, tangere mollissimis, plus minusve particulis cuticularibus per incrementibus fractis obtectis, subtus pallide brunneis, sparse strigosis praecipue venis, obovatis, ad basim attenuatis cordatis, ad apicem obtuse abrupte acuminatis, penninerviis, costa supra leviter subtus prominenter elevata utrinque pubescenti, supra fulva, subtus plus minusve canescenti vel fulva, nervis ad 12–15-paribus supra gracilibus obscuris, subtus prominenter elevatis et sparse pubescentibus, ad angulo 70–50° divergentibus, rete venularum supra obscuro, subtus elevato strigosoque. Inflorescentia notabilis, axillaris subterminalibusque, inclinata, juventute dense lanosa, rhachidibus griseo-fulvis, mox floribus glabris, brunneis contrastis, infirme pyramidato-paniculata, ad 20–25 cm longa, pedunculo ad 7 cm longo gracile. Flores dioici, ♂ ad 1.8–2 mm longi, pedicello 0.6 mm longo dense et longe canescenti-lanoso, perianthio campanulato fulvo-eburneo, fide coll., lobis in anthesin recurvatis, exterioribus late ovatis, interioribus lanceolatis, ad 1.3 mm longis; staminibus I & II 0.8 mm longis, antheris subrotundatis quam filamentis satis robustis, duplo longioribus, ser III ad 1.0 mm longis, antheris leviter emarginatis, filamentis biglandulosis, glandulis parvis, basalibus, subcordatis subsessilibus, ad 0.4 mm longis, ser IV staminodeis parvis, ad 0.4 mm longis pubescentibus, obtuso-lanceolatis, gynoecio abortivo lanceolato ad 0.9 mm longo; ♀ flores, (?) infructescentia et fructus ignoti.

Type. Tree 10 m tall, leaves chartaceous, deep green above, gray green below, inflorescence showy, drooping, rachis gray-buff, flowers pale greenish white to buff-creamy, Raudales de Maihia a lo largo del Río Paragua, lat. 4° 25′; long. 63° 7′, altura 500–510 metros, Bolívar, Venezuela, 1° de Enero, 1962, *Julian A. Steyermark 90535* (holotype, ♂ fl. NY).

Distribution. A tree to 10 m with subverticillate leaves, deep green above and gray beneath, the subterminal, showy inflorescences to 20 cm long, drooping, wooly tomentose, known only from the type locality, and possibly from the Caroní area of Venezuela not too far distant, along river banks, at an altitude of about 500 m. VENEZUELA. Bolívar: Pluvial-ripario, Urimán, Isla Tirica, arbol que se encontraba doblado hacia la corriente del río, *Bernardi 1626* (?♀ fl. NY). It is possible that this pistillate flowering specimen belongs here. I have refrained from a description, since there are some differences between the two

sheets. The leaves of the Bernardi number are much more coriaceous, the tomentum of the inflorescences is more fulvous than gray.

Endlicheria bracteolata (Meissner) C. K. Allen, Mem. N. Y. Bot. Gard. **10**(5): 64. 1964.

Additional Distribution. VENEZUELA. Bolívar: in low woodlands 2 km S of Río Chibau, on right hand bank, *Maguire, Steyermark & Maguire 53519* (y.fr. NY); Sierra Ichún, cercanías del Salto María Espuma (Salto Ichún), del Río Ichún, tributario del Río Paragua, *Steyermark 90316* (♀ fl. NY). BRITISH GUIANA. Locally frequent in marshy area, mixed evergreen forest along Kamarang River, Utschi River mouth, *S. S. & C. L. Tillett 45705* (♀ fl. NY). BRAZIL. Territorio Amapá: Rio Oiapoque, occasional at edge of Rio Ingarari, 0–3 km from confluence with Rio Oiapoque, *Irwin, Pires & Westra 48290* (♀ fl. NY); low forest near Encampment 7, Colonia do Torrão, *Pires & Cavalcante 52649* (♂ fl. IAN, NY). COLOMBIA. Amazonas-Vaupés: Río Apaporis, Raudal de Jirijirimo, *Schultes & Cabrera 14606* (♂ fl. US).

Ocotea costulata (Nees) Mez, Jahrb. Bot. Gart. Berlin **5**: 244. 1889. Allen, Mem. N. Y. Bot. Gard. **10**(5): 77. 1964.

Additional Distribution. BRITISH GUIANA. Upper Mazaruni River Basin, infrequent on Partang Savannah, near mouth of Partang River, Merume Mountains, *Maguire, S. S. & C. L. Tillett 43813* (fl. NY).

Ocotea olivacea A. C. Smith, Bull. Torrey Club **58**: 105. 1931.

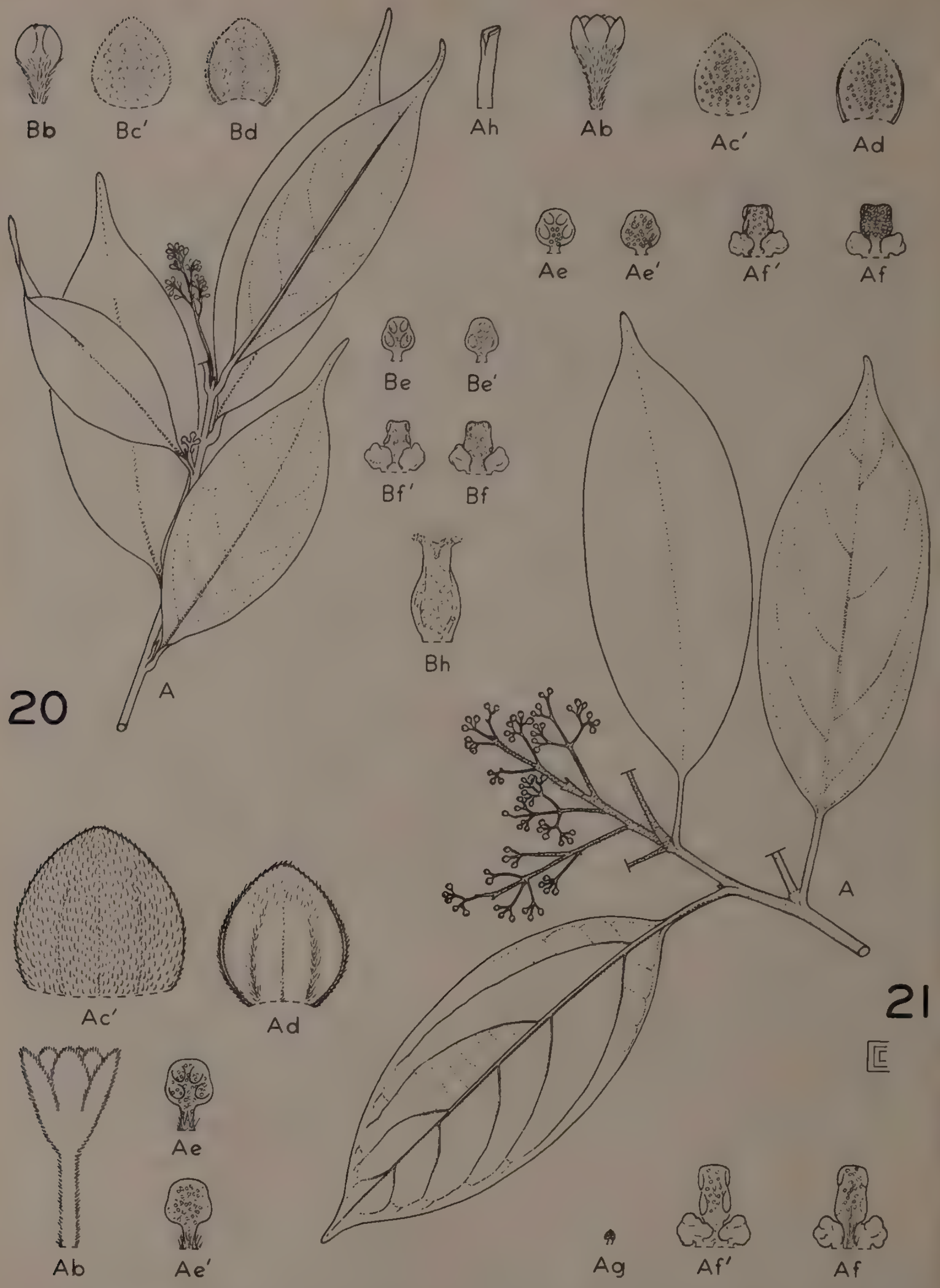
Type. Tree 35–40 feet, petals white, anthers yellow, woods, Iquitos, Loreto, Peru, about 100 m, 26 Sep 1929, *E. P. Killip & A. C. Smith 29843* (holotype, fl. NY).

Distribution. Tree 35–40 feet, with conspicuously angled, reddish brown branchlets, occurring at 100–200 m, in the Vaupés area, Colombia, in addition to the type locality. COLOMBIA. Comisaría del Vaupés: *Maguire & Fernandez 44072* (fr. NY).

Aside from its angled branchlets, the species is outstanding in the dried state for the large, ovate-elliptic leaves 35 × 18 cm, cuneate at the base and shortly acuminate at the apex, with sturdy petioles up to 2 cm long, deeply canaliculate. The ellipsoid fruits, with red, hemispheric cupules (in the dried state, rusty) to 7 mm long, 10 mm in diam, narrowing into a stout pedicel, are borne in comparatively narrow infructescences, more or less racemose-paniculate.

Ocotea tillettsiana C. K. Allen, sp. nov. Fig. 23.

Arbor ad 20 m alta, gemmis gracilibus anguste attenuato-ovoideis, minute adpresseque fulvo-tomentellis, ramulis robustis glabrescentibus striatis atratis. Folia alternata, plus minusve ad apicem congesta, petiolis juventute satis robustis mox crassis glabrescentibus mox glabris canaliculatis, ad 2 cm longis et ad 3 mm latis, aliquantum atratis, laminis supra nitidis, et subtus juventute ad basim sparse minuteque fulvo-pubescentibus, mox glabris, coriaceis, obovatis, ad 15 cm longis et 6.5 cm latis, margine minute recurvatis, ad basim cuneatis, ad apicem obtusis, penninerviis, costa supra leviter elevata (ad basim sulcata), subtus valde elevata, nervis 6–9-paribus supra tenuibus subtus leviter elevatis, ad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A
21
Ac′
Ad
Ab
Ae
Ae′
Ag
Af′
Af

FIG. 20. *Ocotea castanea* (A–Ah, *Steyermark 90348* ♀; *90455* ♂). A, habit, flowering branchlet, × 0.5. Ab, flower, × 5. Ac′, tepal, ser I, dorsal, × 10. Ad, tepal, ser II, ventral, × 10. Ae, stamen, ser I & II, ventral, × 10. Ae′, stamen, ser I & II, dorsal, × 10. Af, stamen, ser III, ventral, × 10. Af′, stamen, ser III, dorsal, × 10. Ah, aborted ovary, × 10. Bb, flower, × 5. Bc′, tepal, ser I, dorsal, × 10. Bd, tepal, ser II, ventral, × 10. Be, stamen, ser I & II, ventral, × 10. Be′, stamen, ser I & II, dorsal, × 10. Bf′, stamen, ser III, dorsal, × 10. Bf, stamen, ser III, ventral, × 10. Bh, ovary, × 10. FIG. 21. *Ocotea discrepens* (A–Ag, *Tillett & Tillett 45479* ♂).

angulo 65–60° divergentibus, obscurissime ad marginem confluentibus, rete venularum supra obscuro laxoque, subtus prominenter et tenue minuto. Inflorescentia axillaris subterminalisque, satis robusta, rhachidibus atratis, minute fulvo-pubescentibus glabrescentibus, racemoso-paniculata, ad 15 cm longa, pedunculo ad 6 cm longo, atrato. Flores hermaphroditi, ad 4.5 mm longi, pedicellis ad 1.5–2 mm longis, perianthio cyathiformi, eburneo, fide coll., minute pubescenti, lobis aliquantum crassis ovatis, intus papillosis, ad 2.5 mm longis, tubo ad 0.5 mm longo; staminibus antheris flavis, fide coll. (Tilletts), ovato-quadratis, quam filamentis ad apicem patentibus duplo longioribus, ser I & II ad 1.5 mm longis, locellis introrsis, ser III ad 2 mm longis, locellis superioribus lateralibus, inferioribus extrorsis, biglandulosis, ser IV ? 0; gynoecio ad 1.8 mm longo, ovario ovoideo, quam stylo companulato stigmate subtriangulari expanso paullo longioro. Infructescentia robusta, rhachidibus corallinis fide coll. (Steyermark). Fructus fuscescens, late oblongus brevi-apiculatus, ad 15 × 10–12 mm, cupula parva, discoidea, corallina fide coll. (Steyermark) ad 6 mm diam, pedicello obconico 3–7 mm longo ad apicem 4 mm expanso, minute pallideque ferrugineo-verruculoso, subtenta.

Type. Tree to 20 m, 3 dm base diam, leaves coriaceous, dark green above, medium green beneath with waxy feel, no bloom, slightly aromatic; calyx and corolla cream, stamens yellow; only one seen in mixed evergreen forest, talus from cliffs along NE side, 800–900 m, 15 Aug 1960, Mt. Ayanganna, Upper Mazaruni River Basin, British Guiana, *Stephen S. & Carolyn L. Tillett & Rufas Boyan 45137* (holotype, fl. NY).

Distribution. Tree to 20 m bearing oblanceolate, coriaceous leaves, the upper surface somewhat shining and loosely reticulate, clustered at the tips of the stout, rough, striate branchlets, known only from the type locality and from a single collection from the sandstone area of Venezuela, on the Chimantá Massif. VENEZUELA. Bolívar: between Bluff Camp and low promontory north of Bluff Camp, along west-facing portion of Chimantá-tepuí (Torono-tepuí), *Steyermark 75686* (fr. NY).

The affinities of *O. tillettsiana* are two: *Ocotea cuprea* (Meissner) Mez, from Peru, and described by Mez as subdioecious, differs from *O. tillettsiana* in its coppery pubescent branchlets bearing shorter, oblanceolate leaves with reticulation obscure throughout; *Ocotea oblonga* (Meissner) Mez from French Guiana and Trinidad according to Mez, dioecious, has characters similar to *O. cuprea,* and in fact appears very closely related to the latter. The leaves are more obovate than oblanceolate with obscure reticulation, and the less persistent pubescence seems to be rather more fulvous than cupreous. Of the three entities, *O. tillettsiana* is the most easily recognizable.

Ocotea finium C. K. Allen, sp. nov. Fig. 22.

Arbor ad 15 m alta, cortice fragrante, gemmis ovoideis, attenuato-acuminatis, fulvo-tomentosis, ramulis cinereo-pubescentibus mox glabris griseis. Folia alternata, petiolis satis robustis pubescentibus canaliculatis ad 15 mm longis 1.5 mm latis, laminis utrinque atro-punctulatis conspicue supra glabris obscure areolatis, subtus pubescentibus minute conspicueque atro-punctulatis, supra viridibus in

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A, habit, flowering branchlet, × 0.5. Ab, flower, × 5. Ac′, tepal, ser I, dorsal, × 10. Ad, tepal, ser II, ventral, × 10. Ae, stamen, ser I & II, ventral, × 10. Ae′, stamen, ser I & II, dorsal, × 10. Af, stamen, ser III, ventral, × 10. Af′, stamen, ser III, dorsal, × 10. Ag, staminodium, ser IV, dorsal, × 10.

sicco pallidis, subtus pallidoribus, in sicco fulvis, subcoriaceis, ellipticis, ad basim obtusis ad apicem acutis vel attenuato-acuminatis, acumine gracile ad 2.5 cm longo, penninerviis, costa supra plus minusve plana, subtus elevatis fulvis ad basim glabrescentibus, nervis 4–5-paribus supra obscuris, subtus gracilibus flavis satis obscuris ad angulo 70–60° divergentibus, rete venularum supra obscuro subtus minute areolato. Inflorescentia axillaris, breves, pauciflora, minute fulvo-pubescentia, stricte racemoso-paniculata, ad 3 cm longa saepe in axillis foliis deciduis ferentes, pedunculo ad 6 mm longo. Flores ut videtur dioici, ♀? ad 1.7 mm longi, perianthio campanulato, lobis late ovatis vel subrotundatis, ad 1 mm longis quam tubo duplo longioribus; staminibus sterilibus, ad 0.8 mm longis antheris subquadratis quam filamentis satis gracilibus duplo longioribus, ad basim pubescentibus, ser III biglandulosis glandulis cordatis stipitatis, ser IV 0; gynoecio ad 1.2 mm longo, glabro, ovario ellipsoideo quam filamento satis crasso paullo longiori, ad basim pubescenti; stigmate plus minusve inconspicuo et triangulari. Infructescentia parva sed satis robusta, ad 5 cm longa, minute pubescentia, glabrescentia. Fructus viridescens (fide colls.), oblongo-ellipsoideus, apiculatus, 15 × 10 cm, cupula prominenter lateque urceolata, ad apicem constricta, glauco-viridescente, ad 11 mm longa, 8 mm in diam, et 4 mm alta, pedicello brevi satis incrassato subtenta.

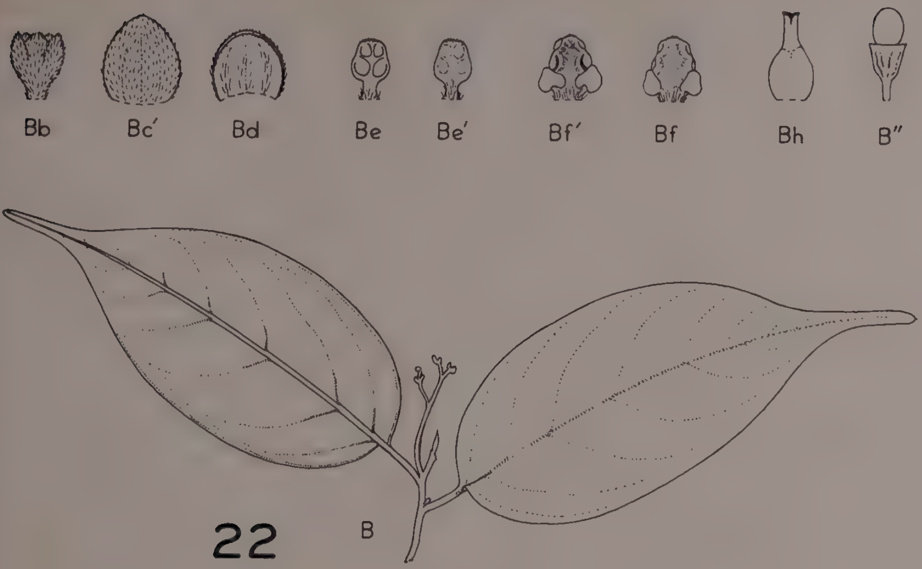
Type. Tree 20 m, leaves subchartaceous, buds creamy, rachis and pedicel yellow-green, rare in mixed montane forest, above escarpment of La Escalera, altitude 850 m, Bolívar, Venezuela, 20–21 Aug 1962, *Bassett Maguire, Julian A. Steyermark & Celia K. Maguire 46846* (holotype, ♀? fl. NY).

Distribution. Tree to 20 m with fragrant bark and chartaceous, green leaves oblong-elliptic or ovate-elliptic long slenderly acuminate, roundish bases, occurring in the Alto Río Cuyuni and Venamo areas of Venezuela along the border of British Guiana. VENEZUELA. Bolívar: Sierra Auraima: en la parte terminal norte sobre el margen oeste del Río Paragua, en la zona del raudal de El Perro; bosque achaparrado sobre piedras areniscas, lat. 6° 32′; long. 63° 33′, *Steyermark 90842* (♀ fl. NY); bosque húmedo montañoso a lo largo del afluente izquierdo (Este), subiendo el Río Venamo desde el campamento cerca de la union con el afluente derecho (Oeste) del Río Venamo, *Steyermark, G. C. K. & E. Dunsterville 92944* (fr. NY).

This border species has, in common with the *O. aciphylla* complex, leaves of similar structure, but they differ from the latter in that the base of the blade is not inrolled. The very short, depauperate inflorescences have the appearance, with the few flowers at the tips of the inflorescences, of the Litseas, but without the involucre characteristic of that genus. There is no doubt of the above-described species being an *Ocotea*.

Ocotea esmeraldana Moldenke in Gleason, Bull. Torrey Club **58**: 362. 1931. Allen, Mem. N. Y. Bot. Gard. **10**(5): 80. 1964.

Additional Distribution. BRAZIL. Amazonas: open country, Campina high land sand soil, Rio Preto, Matupiry, *Froes 22847* (fl. IAN), *22820* (fl. IAN, NY); Rio Içana, Serra de Tunuí caatinga pedregosa, *Black 47-2703* (fr. IAN); em frente de Tunuí (lado oposto), área montanhosa de formação de pedra arenosa, *Froes 28077* (fl. IAN). COLOMBIA. Amazonas: frequent Araracuara Savannas, vicinity Río Caquetá, *Maguire, Celia Maguire & Fernandez 44149* (fl. NY); Río Caquetá, Cerro de La Pedrera, *Schultes & Cabrera 16320* (♂ fl. NY); Comisaría del Vaupés: Río Kubiju (tributary of Río Vaupés), Cerro Kañendá, savannahs



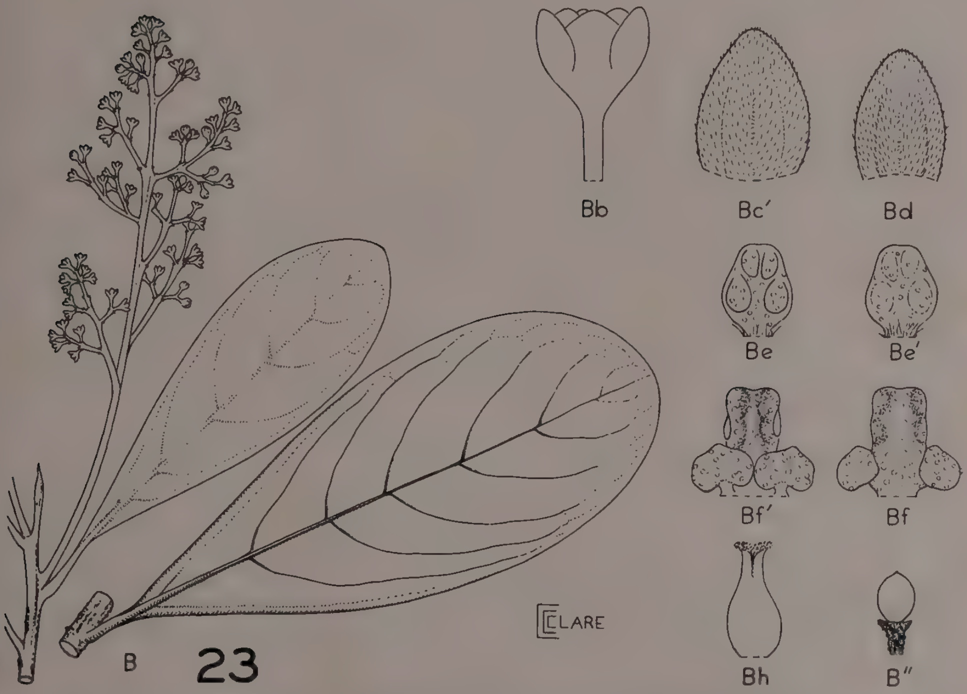


FIG. 22. *Ocotea finium* (B–Bh, *Maguire, Steyermark & Maguire 46846* ♀). B, habit, flowering branchlet, × 0.5. Bb, flower, × 5. Bc′, tepal, ser I, dorsal, × 10. Bd, tepal, ser II, ventral, × 10. Be, stamen, ser I & II, ventral, × 10. Be′, stamen, ser I & II, dorsal, × 10. Bf, stamen, ser III, ventral, × 10. Bf′, stamen, ser III, dorsal, × 10. Bh, ovary, × 10. B″, fruit, × 0.5. FIG. 23. *Ocotea tillettsiana* (B–Bh, *Tillett, Tillett & Boyan 45137*). B, habit, flowering branchlet, × 0.5. Bb, flower, × 5. Bc′, tepal, ser I, dorsal, × 10. Bd, tepal, ser II, ventral, × 10. Be, stamen, ser I & II, ventral, × 10. Be′, stamen, ser I & II, dorsal, × 10. Bf, stamen, ser III, ventral, × 10. Bf′, stamen, ser III, dorsal, × 10. Bh, ovary, × 10. B″, fruit, × 0.5

about 15 miles upstream from mouth, quartzite base, *Schultes & Cabrera 18322* (fl. NY, US); Río Paraná Pichuna (tributary of Río Vaupés), *19920* (fl. US). Río Kuduyarí (tributary of Río Vaupés); Yapobodá, quartzite savannah near head waters, *19974* (fl. NY), *20040* (fl. US).

Ocotea castanea C. K. Allen, sp. nov. Fig. 20.

Arbor ad 8 m alta, gemmis parvis anguste ovoideis attenuatis griseo-sericeis subfalcatis, ramulis subverticillatis, fide coll., juventute minute pubescentibus mox glabratis atratis teretibus. Folia alternata, petiolis satis gracilibus ad 0.5–1 cm longis ad 1–1.5 cm latis, laminis utrinque plus minusve castaneis supra aliquandum olivaceo-maculosis, coriaceis, ellipticis, 8–12 cm longis et 3–4(–5) cm latis, ad basim acutis vel attenuato-acutis, ad apicem attenuato-acuminatis, acumine ad 2 cm longo saepe falcato, penninerviis, costa utrinque glabra, ad basim supra excepta et subtus axillibus glandulosis pubescentibus, supra obscura, subtus elevata nervis 4–5-paribus utrinque obscuris ad 70–60° divergentibus, rete venularum utrinque obscuro. Inflorescentia subterminalis, raro axillaris, breve, ♂ ad 5–6 cm longa ♀ ad 3 cm vel minus, paniculata plus minusve, brevipedunculata, griseo-pubescentia. Flores dioici, vel polygamo-dioici, ♀ flores (in gemmis) ad 2.5 mm longis, pedicello ad 0.5 mm longo; perianthio campanulato, pallide viridescenti, fide coll., lobis glabris ovatis ad 1 mm longis, tubo 0.8 mm longo, pubescenti; staminibus ad 0.7 mm longis, antheris subquadratis quam filamentis satis gracilibus duplo longioribus, ser III biglandulosis, glandulis ad 0.3 mm longis, ser IV 0; gynoecio ad 1.2 mm longo, ovario ellipsoideo quam stylo robusto paullo longioribus, stigmate triangulari paullo expanso; ♂ flores ♀ similes, gynoecio abortivo filamentosos ad 0.8 mm longo excepto, stigmate conspicuo triangulari. Infructescentia et fructus ignoti.

Type. Tree 8 m tall, leaves coriaceous, deep green and shining above, dull green below, flowers pale green, along north side of river, Sierra Ichún, cercanías del Salto María Espuma (Salto Ichún) del Río Ichún, base de la sierra de Ichún, tributario del Río Paragua, lat. 4° 46′; long. 63° 18′, altura 500 metros, Bolívar, Venezuela, 28 de Deciembre 1961, *Julian A. Steyermark 90348* (holotype, ♀ fl. NY).

Distribution. Tree to 8 m tall, with subverticillate branchlets with small (8–12 cm), subcoriaceous, concolorous, elliptic, acuminate leaves, and small, subterminal inflorescences known only from the type locality and vicinity. VENEZUELA. Bolívar: Cercanías del campamento en el lado sur del Río Ichún, tributario de Río Paragua, debajo del Salto María Espuma (Salto Ichún), en suelo arenoso, lat. 4° 46′; long. 63° 18′, *Steyermark 90455* (♂ fl. NY).

The inflorescences present an unusual appearance in this species, the dense pubescence which clothes the rachis, pedicels and tubes of the flowers contrasting with the entirely glabrous perianth, particularly in bud. The leaves, a chestnut-brown throughout, are another distinguishing feature. The species might be related to the *O. florulenta* group, but is readily distinguished by its lack of prominent reticulation.

Ocotea fasciculata (Nees) Mez, Jahrb. Bot. Gart. Berlin **5**: 248. 1889; Allen, Mem. N. Y. Bot. Gard. **10**(5): 108. 1964.

Additional Distribution. SURINAME. Zuid Rivier, tree overhanging riparian vegetation, 2 km above confluence with Lucie Rivier, *Maguire, Schulz, Soderstrom & Holmgren 54057* (fl. fr. NY); Wilhelmina Gebergte, clumps on forested hills,

9 km N of Lucie Rivier, 12 km W of Oost Rivier, *54241*, *54271* (fl. NY); riverine rainforest Zuid Rivier, ca. 2 km above confluence with Lucie Rivier, *Irwin, Prance, Soderstrom & Holmgren 55858* (fl. y.fr. NY). VENEZUELA. Bolívar: Altiplanicie de Nuria, undulating wooded areas bordering savanna, 7.5 km SE of campamento Nuria, along pica 107, *Steyermark 86553* (fl. post anth. NY); more or less level forest along pica 105, 40 km S of Tumeremo, E of highway between Tumeremo and El Dorado, 29 km N of El Dorado, *86579* (fl. NY), cloud forest, summit of west-facing wooded escarpment, E of Miamo, leading to Hato de Nuria *88552* (fl., fr. NY), forest at base of cerro, southeast of Cerro Pichacho, N of Las Nieves, 45 km N of Tumeremo, *88911* (fr. NY), summit of wooded rocky (igneous) cerro between Las Nieves and base of slopes southeast of Cerro Pichacho, *89290* (fr. NY).

The collections from Amapa are consistent in agreement with the type material at hand. The Steyermark collections from Venezuela vary slightly in having very sparsely flowered inflorescences and leaves generally larger than those of the type, but are consistent for their area.

Ocotea gracilis (Meissner) Mez, Jahrb. Bot. Gart. Berlin **5**: 327. 1889; Allen, Mem. N. Y. Bot. Gard. **10**(5): 108. 1964.

Additional Distribution. BRAZIL. Amazonas: Rio Negro, in rocky soil on island, *Froes 22436* (fr. IAN), região do Rio Negro, Galoruca, caatinga, terreno baixo, *28301* (fr. IAN), Paduiry, Tapera, caatinga sand soil, *22907* (fl. IAN); Baixo, Rio Negro, lugar Acajatuba, campina à beira da mata, *Ducke s.n.* (fr. IAN); Rio Solimões, região do Fonte Bôa, *Froes 34777* (fr. IAN). COLOMBIA. Vaupés: Río Negro, San Felipe and vicinity (below confluence of Río Guainía and Río Casiquiare), *Schultes, Baker & Cabrera 18084* (fr. NY, US), Río Karurú (tributary of Río Vaupés), Mesa de Yambí, savannah Goo-ran-hoo-dá, Quartzite base, *Schultes & Cabrera 19151* (fl. NY, US), *19160* (fr. NY, US). Amazonas: Río Miritiparaná, Caño Guacayá, *16393* (fr. NY, US).

Ocotea depauperata C. K. Allen, sp. nov. Fig. 19.

Frutex (?) extensa, ad 1.5 m alta, gemmis minutis lanceolato-ellipsoideis minute griseo-pubescentibus?, ramulis gracilibus debilibus flexuosis (discursis torti vibratique) atratis minute inconspicueque pubescentibus. Folia alternata, petiolis gracilibus atratis ad 5–6 mm longis et 1(–1.5) mm longis, laminis supra rufo-brunneis, in sicco, subtus pallide subcastaneo-brunneis, utrinque glabris supra ut videtur minute farinosis ovato-lanceolatis vel anguste ovatis, ad (5–)8–10 mm longis et (2–)3–4 cm latis, ad basim obtusatis subrotundatisve, ad apicem attenuato-acuminatis, acumine ad 2 cm longis, raro acutis, margine minute revolutis, penninerviis, costa supra pallide rufa plus minusve plana, subtus elevatis conspicuioribus concoloribus, nervis? ad 12-paribus obscure rufis inconspicuis ad angulo 60–50° divergentibus, subtus perinconspicuis concoloribus, rete venularum supra laxo inconspicuo, subtus obscuro. Inflorescentia depauperata, axillaris, pauciflora, gracilis, atrata, sparse pubescentia, brevipedunculata. Flores dioici, ♂ ad 3.6 mm longi, perianthio campanulato gracili, lobis exterioribus lanceolatis interioribus ovatis ad 1.4 mm longis quam tubo plus minusve duplo longioribus; staminibus ad 9 mm longis, ser I & II, antheris ovato-truncatis quam filamentis satis crassis duplo longioribus, ser III antheris aliquantum rectangularibus biglandulosis, glandulis 0.4 mm longis stipitatis quam filamentis paullo longioribus, ser IV 0; gynoecio abortivo filamentoso ad

0.7 mm longo; flores ♀ ignoti. Infructescentia breves, depauperata sed plus minusve robusta ad 3.5 cm longa, glabra. Fructus ovoideo-ellipsoideus, ad 12 × 8 mm cupula vade tubaeformi obscure denticulata ad 15 mm longa, pedicello indistincte delimitato incluso, ad 6 mm diam, et ad 2 mm alta subtentus.

Type. Sprawling tree 1.5 m tall, leaves coriaceous, deep green above, pale green below, flowers pale green, on summit of Sierra Ichún, laderas boscosas al norte del Salto María Espuma (Salto Ichún), a lo largo del Río Ichún (tributario del Río Paragua), lat. 4° 46′; long. 63° 18′), altura 625–725 metros, 27 de Diciembre 1961, *Julian A. Steyermark 90270* (holotype, ♂ fl. NY).

Distribution. Sprawling tree to 1.5 m tall with ovate-lanceolate leaves attenuately acuminate, numerous close, almost horizontal, lateral nerves, and few, short, axillary, depauperate inflorescences, known only from the type locality in Venezuela in the sandstone area from 625 to 725 m altitude. VENEZUELA. Bolívar: *Steyermark 90261A* (fr. NY).

At first glance the fruiting number does not appear to be conspecific with the type, a staminate collection. Closer examination fails to reveal characters sufficiently different to warrant a separation of the two collections.

Ocotea mirecolorata C. K. Allen, sp. nov. Fig. 24.

Arbor ad 20 m alta, gemmis parvis ovoideis dense ferrugineo- vel griseo-tomentosis, ramulis novellis (inflorescentibus foliisque inclusis) dense notabileque ferrugineo-tomentosis mox glabrescentibus et atratis mox striatis glabris. Folia alternata, petiolis robustis juventute ferrugineo-tomentosis mox atro-tomentosis, ad basim leviter canaliculatis ad 15 mm longis et ad 2 mm latis, laminis supra glabris, costa nervisque exceptis, juventute areolatis, mox perlucidis, areolis inconspicuis, viridibus (in sicco flavo-viridecentibus) coriaceis lanceolato-ellipticis, ad 12.5(–14) cm longis et 3.5(–4) cm latis, ad basim plus minusve obtusatis, ad apicem acutis vel acuminatis (raro obtusis vel abrupte minuteque acuminatis), penninerviis, costa supra leviter subtus prominenter elevata, supra ad basim satis pubescenti, subtus dense pubescenti, nervis (4–)5–6-paribus supra glabris, gracilibus subtus pubescentibus, prominenter elevatis, ad angulo 70° divergentibus, rete venularum supra inconspicuo subtus prominenter elevato et pubescenti. Inflorescentia ut videtur omnino terminalis, sed inconspicue axillaris, dense ferrugineo-tomentosa robusta racemoso-paniculata ad 8 cm longa, pedunculo 1–1.5 cm longo robusto. Flores dioici, flavo-viridescenti, fide colls., ♂ ad 11 mm longi, dense ferrugineo-tomentosi, pedicellis ad 5 mm longis; perianthio campanulato crassuloso, flavo-viridescenti, lobis extus brunneo-tomentosis, ovatis 5.5 mm (interioribus 4 mm) longis, intus papillosis, tubo brevi; staminibus ser I & II variabilis conspicue petalloideis, antheris trinerviis, ad 2.4 mm longis, ser I late ovatis, ad basim subcordatis, ad apicem obtuso-emarginatis, subsessilibus, ser II ovatis quam ser I angustioribus, filamentis brevibus, ser III ad 4 mm longis, antheris plus minusve rectangularibus biglandulosis, glandulis ad 1.5 mm longis, stipitatis, ser IV 0?; gynoecio abortivo vel 0; ♀ flores, infructescentia et fructus ignoti.

Type. Tree to 30 m, 6 dm base diameter, leaves dark green above, lighter matte green beneath, brittle, not aromatic; inflorescence green with brown tomentum, calyx light yellowish green, brown tomentum without, stamens green, pores yellow; infrequent, mixed evergreen forest, ca. 950 m, E arm of Karowtipu, Kako River, Upper Mazaruni River Basin, British Guiana, *Stephen S. & Carolyn L. Tillett 45580* (holotype, ♂ fl. NY).

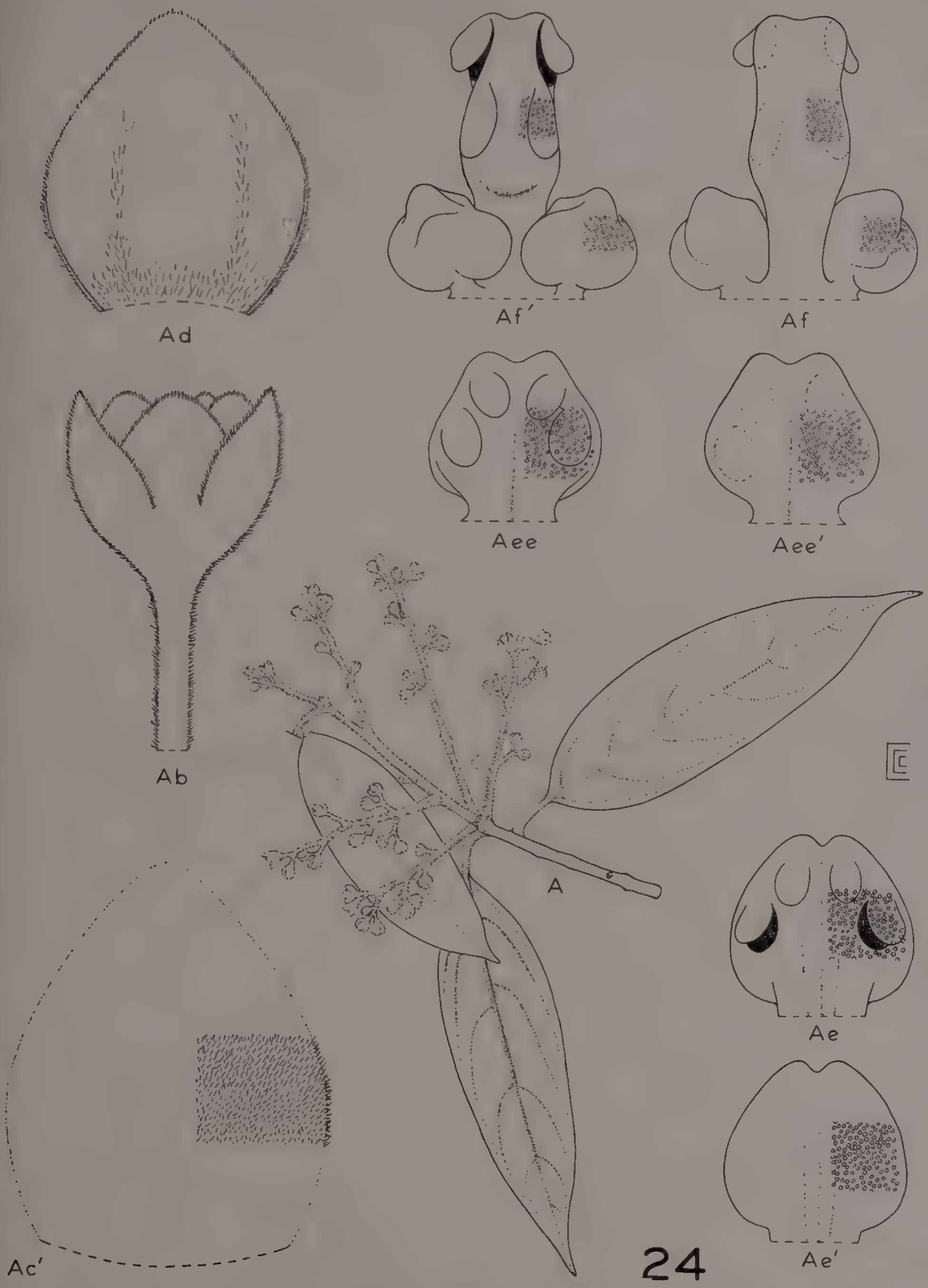


FIG. 24. *Ocotea mirecolorata* (A–Af′, *Tillett & Tillett 45580* ♂). A, habit, flowering branchlet, × 0.5. Ab, flower, × 5. Ac′, tepal, ser I, dorsal, × 10. Ad, tepal, ser II, ventral, × 10. Ae, stamen, ser I, ventral, × 10. Ae′, stamen, ser I, dorsal, × 10. Aee, stamen, ser II, ventral, × 10. Aee′, stamen, ser II, dorsal, × 10. Af, stamen, ser III, ventral, × 10. Af′, stamen, ser III, dorsal, × 10.

Distribution. A tree to 30 m, striking because of the dense, bright ferruginous tomentum (brown fide colls.) clothing the young branchlets and inflorescences, in contrast to the dark green leaves paler beneath. The unusual petalloidy of the two outer staminal cycles gives the appearance of some members of the genus *Nectandra*. The third staminal cycle, however, and the absence of a gynoecium place the specimen in *Ocotea* in the section with dioiceous flowers. Fruiting material will undoubtedly make it possible to assign the species to its proper place in the genus.

Ocotea discrepens C. K. Allen, sp. nov. Fig. 21.

Arbor 15–25 m alta, gemmis subferrugineo-tomentosis, ramulis teretibus dense ferrugineo-tomentosis mox robustis striatis atris glabrescentibus. Folia alternata, petiolis satis robustis ad 25 mm longis atratis minute tomentellis striatis, laminis juventute sparse fulvo- vel ferrugineo-strigosis supra mox glabrescentibus venis exceptis subtus nunc pallide fulvo-strigosis nunc glaucis et solum omnibus venis pubescentibus, coriaceis supra immaturis conspicue reticulatis praecoccibus, et saepe dense atro-punctulatis, mox obscuris, ellipticis vel raro oblongo-ellipticis, 15–20(–25) cm longis et (3.5–)4–5.5(–9) cm latis, ad basim acutis vel raro obtusis, ad apicem longe acuminatis, acuminibus ad 2, raro 3 cm longis gracilibus saepe acutissimis, vel foliis floralibus raro emarginatibus vel obtusis, penninerviis, costis supra leviter subtus prominenter elevatis, supra atro-ferrugineo-pubescentibus, mox glabrescentibus, subtus glabrescentibus mox flavescentibus, nervis satis gracilibus 5–6-paribus supra mox atro-ferrugineo-pubescentibus mox obscuris flavescentibus, ad angulo 70–60° divergentibus. Inflorescentia subterminalis axillarisque, multiflora, fulvo- vel ferrugineo-pubescentia, racemoso-paniculata, vel pyramidato-paniculata, ad 14 cm longa, pedunculo brevissime. Flores dioici, ♂ flores ad 5.5 mm longi, pedicello ad 2.2 mm longo, perianthio suburcellato, lobis ovatis ad 2.8 mm longis, staminibus ad basim pubescentibus, ser I & II, ad 0.9 mm longis antheris subquadratis quam filamentis gracilibus duplo longioribus, ser III ad 1.1 mm longis, antheris rectangularibus quam filamentis duplo longioribus, biglandulosis, glandulis cordatis brevistipitatis, ser IV ad 0.2 mm longis, subcordatis pubescentibus stipitatis; gynoecio 0; flores ♀, infructescentia et fructus ignoti.

Type. Tree to 15 m, 2 dm base diameter, bark smooth, reddish, leaves dark green above, lighter and glaucous beneath, not aromatic, calyx yellow, flushed with pink, corolla yellow, stamens green, glands yellow, pistil yellowish green, slight fragrance; only one seen, forest on laterite at base of talus, Pat Bailey's line to top of Karowtipu, Kako River, ca. 500 m, Upper Mazaruni River Basin, British Guiana, 21 Sep 1960, *Stephen S. & Carolyn L. Tillett 45479* (holotype, ♂ fl. NY).

Distribution. Tree to 25 m with leaves dark green above (pale yellow-green in dried state), glaucous with conspicuous venation showing yellowish beneath, in the dried state; the racemose-paniculate, ferruginous tomentose inflorescences are axillary or subterminal, many-flowered, and angular rather than graceful. The species is found in forested hills in British Guiana and Suriname at an altitude of 275–500 m. BRITISH GUIANA. Upper Mazaruni River Basin, frequent in fluvial forest along S bank, Camp #3, 1/2 mile below ''falls'' of Kako River, about 10 hours from mouth, *S. S. & C. L. Tillett 45489* (♂ fl. NY); basin of Kuyuwini River (Essequibo tributary) about 150 miles from mouth, in dense forest, *Smith 2637* (♂ fl. NY). SURNAME. Wilhelmina Gebergte, forested hills

ca. 3 km S of Juliana Top, 12 km N of Lucie Rivier, alt. 300 m, *Maguire, Schulz, Soderstrom & Holmgren 54450* (♂ fl. NY); forested hills, ca. 9 km N of Lucie Rivier, 12 km W of Oost Rivier, *Irwin, Prance, Soderstrom & Holmgren 54557* (♂ fl. NY).

The species recalls in leaf structure and venation some species of *Endlicheria*, but the floral structure is definitely that of *Ocotea*. Within the genus, however, the relationship is not easily recognizable without fruiting material. Tillett's *45489* is a more robust specimen the leaves being much larger, and the inflorescences longer and more fully flowered.

Ocotea duotincta C. K. Allen, sp. nov. Fig. 16.

Arbor ad 20 m alta, gemmis ovoideis acuminatis dense ferrugineo-tomentellis (raro in sicco griseo-tomentellis), ramulis juventute item ferrugineo-tomentellis mox glabrescentibus sulcatis mox striatis. Folia alternata, petiolis satis crassis tomentellis canaliculatis striatisque ad 15(–20) mm longis et ad 2 mm latis, laminis supra glabris costa ad basim excepta, subtus ferrugineo-pubescentibus praecipue costa nervisque, mox plus minusve glabrescentibus, utrinque sparse minute atro-punctata, subcoriaceis coriaceisve lanceolato-ellipticis, raro oblongis, (11–)15–20(–22) cm longis et (2.5–)5–6 cm latis, ad basim plus minusve obtusis, ad apicem acuminatis vel attenuato-acuminatis, saepe margine recurvatis praecipue ad basim, penninerviis, costa flavescente supra leviter impressa, subtus prominenter pubescente elevata, nervis 6–8-paribus supra aliquantum impressis inconspicuis, subtus elevatis pubescentibus, ad angulo (70–)65–60° divergentibus, rete venularum supra saepe conspicuo, subtus haud conspicuo. Inflorescentia axillaris breve 8 cm vel minus longo, raro 10 cm, minute subferrugineo-tomentella, racemoso-paniculata, rhachidibus pallide viridescenti-fulvis, fide coll., pedunculo breve pubescente. Flores dioici, ♂ ad 2–4 mm longi, minute pubescentes, pedicello ad 1.5 mm longo, perianthio plus minusve cyathiformi, eburneo-fulvi, fide coll., lobis satis crassis ovato-ellipticis plus minusve papillosis, ad 2 mm longis quam tubo tertiam partem longioribus; staminibus ser I & II ad 10 mm longis, antheris late ovatis plus minusve truncatis quam filamentis duplo longioribus, ser III ad 10 mm longis, antheris plus minusve quadratis filamentis subaequantibus biglandulosis, glandulis ad 0.6 mm longis aliquantum clavatis crasse longeque stipitatis, ser IV 0; gynoecio abortivo filamentoso, ad 1.4 mm longo, stigmate tenue expanso; ♀ flores ignoti. Infructescentia immatura, subferrugineo-pubescentia, glabrescentia, debilia, ad 8 cm longa. Fructus immaturus, flavo-viridescens, fide coll., cupula ut videtur subhemispherica, olivaceo-viridescente, fide coll., in sicco fulvo-verruculosa subtenta.

Type. Tree 15 m tall, leaves subcoriaceous-chartaceous, dark green above, silvery gray below, flowers creamy buff, rachis pale green-buff, young stem buff-brown, bosque alto húmedo montañoso, entre la ladera principal escarpada de arenisca y el salto en el Río Venamo, altura 900–1000 metros, Bolívar, Venezuela, 8 de Enero 1964, *Julian A. Steyermark, G. C. K. & E. Dunsterville 92880* (holotype, ♂ fl. NY).

Distribution. Tree 10–15 m, the young branchlets and inflorescences densely ferruginous-tomentellous and the subcoriaceous to chartaceous leaves dark green above and silvery gray below, the flowers creamy buff, borne on pale green racheae. The taxon occurs in Bolívar in Venezuela, along the border of British Guiana in the sandstone area. VENEZUELA. Bolívar: Río Chicanán, on southeast escarpment of Cerro Pitón, Cordillera Epicara, *Maguire, Steyermark &*

Maguire 53638 (y.fr. NY), frequent in dry, low semiopen woodland on sandstone, between Salto Pitón and Quebrada Franela, *53685* (y.fr. NY); bosque alto húmedo montañoso, entre la base de la ladera principal escarpada de arenisca y de Cerro Venamo (parte Oeste) salto en el Río Venamo, *Steyermark & G. & E. Dunsterville 92765* (fr. NY).

The specimens cited here consistently show leaves less ovate-lanceolate or ovate-elliptic, than lanceolate, except for the number *92880* the leaves of which are oblong with less attenuate apices. The two Maguire numbers vary in leaf characters but not sufficiently to warrant exclusion from the taxon. Steyermark & Dunsterville's *92794* from the same locality as *92765* possibly may be affiliated with the species; the single fruit seemingly is abnormal; the leaves vary in shape, their bases being long-cuneate.

The species is perhaps somewhat related to *O. lasseriana* Allen, but the strictly axillary short inflorescences (not more than 10 and usually less than 8 cm long) distinguish it from the latter, as well as the consistently noted silvery under-leaf surface.

Ocotea aff. **acutangula** (Miquel) Mez, Jahrb. Bot. Gart. Berlin **5**: 330. 1889.

Nectandra acutangula Miquel, Linnaea **22**: 806. 1849.

Type. Bahía, Brazil, *I. Blanchet 2961* (fide Miquel; *3961,* fide Mez, Meissner), isotype fl., A (*3961*), *?NY* (*s.n.*).

Distribution. Tree or shrub with conspicuously angled branchlets early clothed with cinereous, tomentellous pubescence, which presently disappears, bearing leaves that are elliptic or oblong-elliptic, heavily coriaceous, the margins recurved and subterminal and axillary inflorescences densely pubescent. Described from Bahía, Brazil, and reported from French Guiana and southern Brazil. BRITISH GUIANA. Upper Mazaruni Basin, infrequent in medium high forest, SE ridge of Merume Mountain, *S. S. & C. L. Tillett & Boyan 44839* (♀ fl. NY).

The number cited above bears leaves generally more oblong and less sharply acuminate; the branchlets are not as sharply nor as conspicuously angled as those of the type. I have seen no other specimen with a pistillate flower, nor any fruiting material. Further collections should clarify this little known species.

Ocotea persulcata C. K. Allen, sp. nov. Fig. 25.

Arbor parva, gemmis ellipsoideis obtuse acuminatis fulvo-tomentellis, ramulis sulcatis brunneis fulvisque minute tomentellis. Folia magna alternata, petiolis crassis ad 20 mm longis et 4–5 mm latis minute fulvo- vel brunneo-pubescentibus canaliculatis, laminis coriaceis supra olivaceis opacis subtus fulvo-sericeis, ellipticis ad basim obtusatis ad apicem plerumque acute acuminatis cuspidatis, penninerviis, costa supra plana ad basim leviter elevata conspicuaque, subtus elevata dense fulvo-sericea, nervis 9–10-paribus supra pallidis plus minusve planis subtus elevatis dense fulvo-sericeis ad angulo 50–60° divergentibus, rete venularum supra gracili pallido subtus elevata pubescentibus obscuris. Inflorescentia solitaria, subterminalis, multiflora, satis robusta, fulvo-pubescens, pyramidato-paniculata, ad 17 cm longa, pedunculo robusto striato fulvo-pubescenti, ad 4 cm longo, basi tumescenti, saepe ramulis adscendentibus. Flores hermaphroditi vel dioici? (post anthesin) ad 3.2 mm longi, pedicellis ad 1.8 mm longis, perianthio campanulato, eburneo, fide colls., papilloso, lobis ovatis ad 1.8–2 mm longis, tubo ad 1 mm

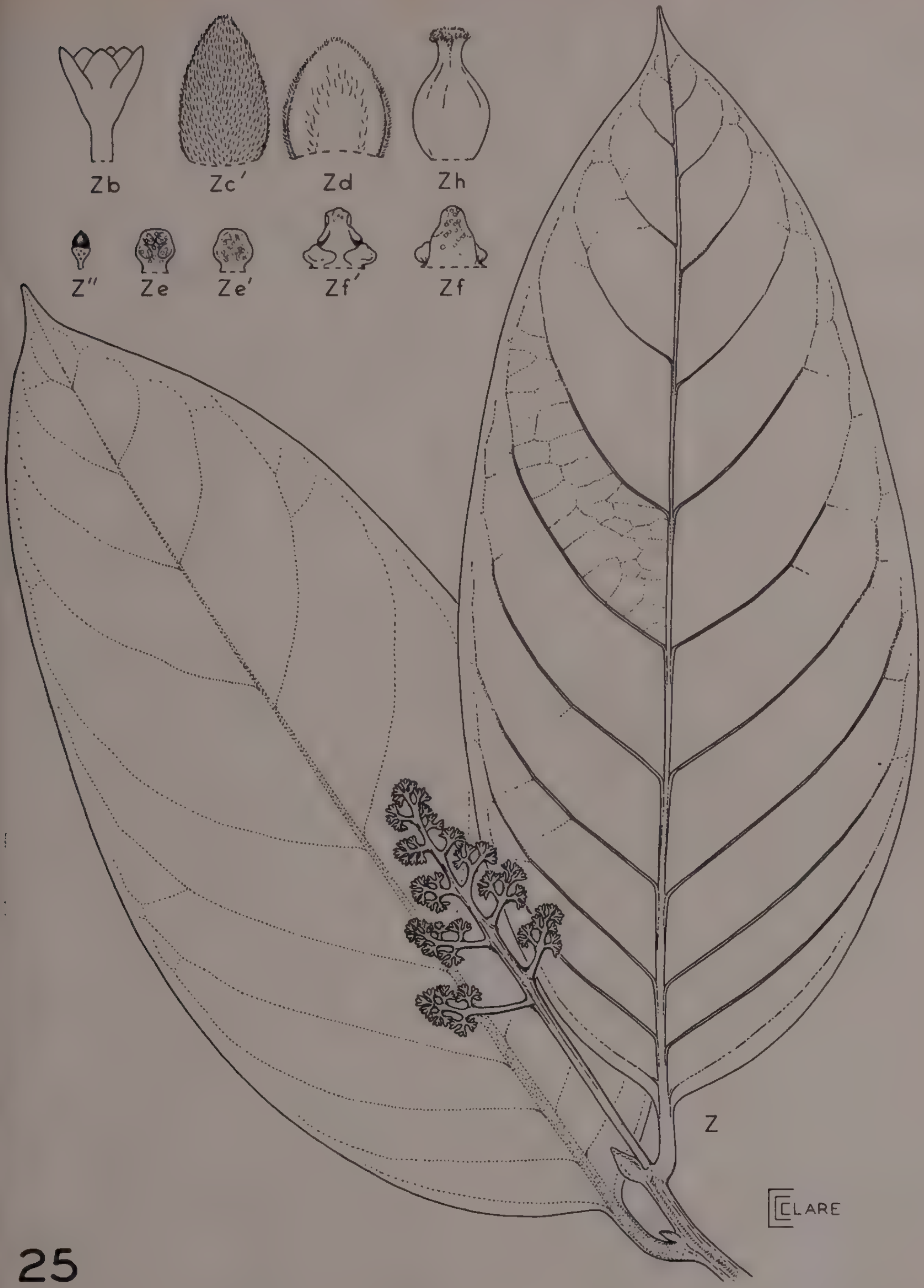


FIG. 25. *Ocotea persulcata* (Z–Zh, *Maguire, Maguire & Wilson-Browne 45926A*). Z, habit, flowering branchlet, × 0.5. Z″, fruit, × 0.5. Zb, flower, × 5. Zc′, tepal, ser I, dorsal, × 10. Zd, tepal, ser II, ventral, × 10. Ze, stamen, ser I & II, ventral, × 10. Ze′, stamen, ser I & II, dorsal, × 10. Zf, stamen, ser III, ventral, × 10. Zf′, stamen, ser III, dorsal, × 10. Zh, ovary, × 10.

longo; staminibus ser I & II ad 0.5 mm longis, antheris ovato-subtruncatis plusquam filamentis robustis brevibus triplo longioribus, ser III ad 0.8 mm longis, antheris obtuse ovatis biglandulosis quam glandulis et filamentis triplo longioribus, ser IV 0; gynoecio ad 1.8 mm glabro, ovario ellipsoideo quam stylo satis robusto duplo longiori, stigmate subtriangulari leviter patenti. Infructescentia fracta, robusta, brunneo-pubescens, striata. Fructus immaturus, oblongus, apiculatus, cupula gracile vadosa fulgente minute fulvo-verruculosa subtentus.

Type. Small tree, flowers cream-colored, occasional, Kamana Falls (Camp 1), collecting for 1–2 miles below falls, sandstone and conglomerate, altitude 2200 feet, Southern Pakaraima Mountains, British Guiana, 24 Aug 1961, *Bassett Maguire, Celia K. Maguire & G. Wilson-Browne 45926A* (holotype, fl. NY).

Distribution. Small tree with large oblong-elliptic leaves fulvo-sericeous beneath with deeply sulcate branchlets and solitary, subterminal inflorescences, pyramidal-paniculate, bearing cream-colored flowers. The species is known only from the single specimen collected in southern Pakaraima Mountains.

The affinity of this large-leaved species may be with *Ocotea leucoxylon* abundant in the Antilles with relatives in the Guianas. This remote connection may very well be strengthened by the acquisition of more complete material. The characters of the immature fruit point in this direction.

Ocotea guianensis Aublet, Pl. Guiane **2**: 781. 1775. Allen, Mem. N. Y. Bot. Gard. **10**(5): 85. 1964.

Additional Distribution. VENEZUELA. Bolívar: Sierra Ichún, laderas boscosas al norte del Salto María Espuma (Salto Ichún) a lo largo del Rio Ichún (tributary del Río Paragua), *Steyermark 90203* (fl. NY). BRAZIL. Territorio Amapá: Rio Oiapoque, occasional on lower and middle slopes of Mt. Tipac, *Irwin 48694* (fr. NY). BRITISH GUIANA. Upper Mazaruni River Basin, locally common, mixed evergreen forest on ridges from escarpment E bank of Kamarang River above Utschi mouth, *S. S. & C. L. Tillett 45797* (fr. NY). COLOMBIA. Comisaría del Vaupés: Río Negro, San Felipe and vicinity (below confluence of Río Guainía and Río Casiquiare), *Schultes, Baker & Cabrera 17963* (fl. NY).

Ocotea martiniana (Nees) Mez, Jahrb. Bot. Gart. Berlin **5**: 344. 1889.

Oreodaphne martiniana Nees, Syst. Laurin. 415. 1836.
Oreodaphne hostmanniana Miquel, Pl. Surinam. 202. 1851. (isosyntype, *Hostmann & Kappler 517*, ♂ fl. NY).

Type. "Cayenne (*Martin*)," French Guiana (isotype, fl. fragm. NY).

Distribution. French and Dutch Guiana and possibly in the southern Pakaraima Mountains of British Guiana are the countries to which this small tree to 10 m (or shrub according to Mez) is native, distinguished by chartaceous leaves, reticulate throughout, and axillary, subterminal inflorescences, in loose, somewhat narrow panicles eventually producing globose fruits. BRITISH GUIANA. Southern Pakaraima Mountains, occasional in vicinity of Camp, Chimapu Creek, second growth area, *Maguire, Maguire & Wilson-Browne 46160A* (♀ fl., fr. NY).

Nectandra cuspidata Nees & Martius in Nees, Syst. Laurin 330. 1836; Allen, Mem. N. Y. Bot. Gard. **10**(5): 114. 1964.

Additional Distribution. VENEZUELA. Bolívar: Bosques a lo largo de la frontera Venezolana-Brasilera, noreste de la Serranía Pia-soi (Pia-shauhy, Pia-

Savi), *Steyermark 90613* (y.fr. NY), frequent along the Alto Río Cuyuni, *Maguire, Steyermark & Maguire 46965* (fl. NY); Delta Amacuro: downstream from San Victor, Río Amacuro, Sierra Imataca, *Steyermark 87294* (fl. NY). BRITISH GUIANA. Upper Mazaruni River Basin: only specimen seen, fluvial forest along S bank, Camp 3, 1/2 mi below "falls" of Kako River, about 10 hours from mouth, *S. S. & C. L. Tillett 45490* (fl. NY). Mt. Ayanganna, locally frequent in disturbed areas, mixed evergreen forest on talus from cliffs along NE side, *S. S. & C. L. Tillett & Boyan 45156* (fl. NY).

These specimens, with the exception of *Steyermark 87294,* are conspecific with the material cited and discussed in the recent treatment of Lauraceae (Mem. N. Y. Bot. Gard. **10**(5): 114. 1964). The afore-mentioned Steyermark number from Delta Amacuro appears to be a larger-leaved variant, the leaves more chartaceous than those of the others cited.

Nectandra meyeriana Lasser, Bol. Soc. Venez. Ci. Nat. **11**(92): 184, *fig.* 1947.

Type. "Selvas nubladas de Rancho Grande, Parque Nacional Edo. Aragua, entre 1000–1200 mts de altura," Venezuela, *H. Pittier 15274* (isotype, NY).

Distribution. Large tree 20–25 m, the branchlets more or less sulcate becoming terete and somewhat striate with age, deep brown tomentose, the inflorescences maroon or yellow-brown tomentose up to 19 cm long, according to the collector, axillary, the subtending leaves oblong-elliptic with shining more or less glabrous uppersurface, yellowish tomentose beneath on the venation (silvery beneath, according to the collector), rounded at the base and very long-acuminate at the apex. Aside from the type locality, this has not been reported elsewhere until the present. VENEZUELA. Bolívar: Cerro Venamo (parte Sur-oeste), Cerca de los Limites con la Guayana inglesa, bosque alto húmedo montañoso, entre la ladera principal escarpada de arenisca y el salto en el Río Venamo, *Steyermark, G. C. K. & E. Dunsterville 92862* (fr. NY).

Despite the disjunct distribution, the fruiting specimen from Guayana appears in every way to be conspecific with Lasser's species. I have not seen the type, but the isoparatype, *Williams 10718,* a flowering specimen, is at hand. The fruiting material is perhaps not fully mature, but may be described as follows: Infructescence to 16 cm long, sturdy, pedicel stout to 2.5 cm long, the rachis brown-magenta, according to the collector, and clothed with a dense tomentum, brownish in the dried state, the maroon, subsessile, hemispheric cupule is campanulate, 8–12 mm long, 4–7 mm deep and up to 15 mm in diameter, subtending the pale green, obovoid (1.5–2.5 × 0.7–1.5 cm) fruit and enclosing it for approximately one-third of its length. The leaf surface of the specimen cited is not shining above as that of the type, nor is the reticulation as pronounced.

The species most closely resembling *N. meyeriana* is *Nectandra kunthiana* (Nees) Kostermans [*Acrodiclidium kunthianum* Nees; *Ocotea kunthianum* (Nees) Mez] which differs in the more consistently oblong leaves, sharply reticulate throughout, with presumably a narrow, slightly acute cusp at the apex. Both species have a shining upper leaf surface which is more or less densely, minutely punctulate and roughly, minutely granular. It would be necessary to compare the types of both taxa, in order to be certain of the genus. The Martin number cited by Mez shows a consistently longer fruiting pedicel than that of the Steyermark & Dunsterville number. *Schomburgk 798,* cited by Mez, also a staminate specimen, is very definitely an *Ocotea.* The isoparatype of *N. meyeriana, Ll. Williams 10718,* has seemingly pistillate flowers with expanded petalloid stamens of the two outer cycles more or less simulating the stamens of the genus *Nectandra.* The illustration accompanying the type, which latter description I have not seen, shows what appears to be a pistillate flower also; the cells of the stamens are not well defined. Until such time as the types are available, it seems preferable to maintain both species.

Pleurothyrium cowaniana C. K. Allen, Mem. N. Y. Bot. Gard. **10**(5): 121, *fig. 59.* 1964.

Fructus nitidus, viridis, fide coll., oblongus vel ellipsoideus, apice plus minusve depresse obtusatus, 25–30 × 17 mm, cupula rubra, fide coll., cyathiforma, vadosa, patenti, ad 6 mm longa et 3 mm alta, ad marginem ad 15 mm diam, stipe ad 5 mm longo, pedicello robusto, ad 2 mm longo.

Additional Distribution. BRITISH GUIANA. Kanuku Mts., *Forest Dept. Brit. Guiana WB379* (*5793*) (fl. NY); Upper Mazaruni River Basin, frequent in mixed evergreen forest on talus from cliffs along NE side, Mt. Ayanganna, *S. S. & C. L. Tillett 45660* (fl., fr. NY).

A disjunct distribution, but one which may with future collections prove to be more continuous. The flowering specimens from Venezuela and British Guiana, allowing for minor variations, appear to be conspecific; however, fruiting material from other areas of the Guayana Highland sandstone may indicate the presence of two taxa.

AQUIFOLIACEAE [26]

Ilex Linnaeus, Sp. Pl. ed. 1, 125. 1753, Gen. Pl. ed. 5, m. 172. 1754.

The fifty-five species of *Ilex* treated in this paper may be divided first into two groups. The section *Guayanoilex* Edwin with about twenty-four species is largely endemic in the Guayana Highland. The remaining thirty-one show relationships with *Ilices* typical of several other floras.

Ilex cowanii Wurdack is close to *Ilex boliviana* Britton, a species of the high Andes native to Bolivia and Ecuador. *Ilex inundata* Poepp. ex Reiss., *I. conocarpa* Reiss. and *I. psammophila* Reiss. are species of the lowland and mountain slope floras of southern and eastern Brazil and also of lowland Colombia. *I. conocarpa* Reiss. is also close to the species of southern Brazil such as *I. microdonta* Reiss. *I. tateana* Steyerm. and *I. laureola* Tr. & Pl. are related to lowland Amazonian species such as *I. brasiliensis* Loes., although both are found at higher elevations. *I. guianensis* (Aubl.) O. Ktze. has its widest distribution in Central America and the Caribbean Islands. *I. martiniana* D. Don., *I. jenmania* Loes. and *I. casiquiarensis* Loes. are representative of species of the Guianas and northern Brazil. *I. ptariana* Steyerm. and *I. parvifructa* Edwin are very closely allied to *I. glaucophylla* Steyerm., a species of maritime Venezuela. *I. theezans* var. *riedelii* is close to *I. paraguariensis* St. Hilaire of Brazil and Paraguay. *I. macarenensis* Cuatr. is representative of the montane species of Colombia such as *I. colombiana* Cuatr. Finally *I. andarensis* Loes. is a native of the Andes Mountains of Peru.

The species of the section *Guayanoilex* undoubtedly arose in or very near the Guayana Highland while the remainder spread into the flora from other areas.

Twenty-two species and seven varieties not before described are now presented. All are endemic in the Guayana Highland. Thirteen of the species and two varieties are included in a new section, which in turn is composed of two new subsections and also two new series.

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[26] By Gabriel Edwin, Assistant Curator, Chicago Natural History Museum, Chicago, Illinois, formerly Botanist, National Arboretum, Washington, D. C.

The descriptions of these taxa do not contain data on prophylla, prophyllate bracts or stipules. None of these seem to be taxonomically significant.

The basic inflorescence types in *Ilex* are trichotomous axillary cymes [27] and dichasia, either simple or compound (Fig. 26).

The cymes at times are reduced to one flower which is borne on a pedicel that in turn is on a peduncle (as indicated by the presence of an abscission line or prophyllate bracts or both). In the descriptions that follow the flowers so situated are described simply as "pedicellate." In the genus truly pedicellate female flowers (where no peduncle is developed) are very rare or lacking.

Key to the Species of *Ilex*

1. Leaf-blades epunctate beneath.
  2. Flowers (at least the perianth) (5–)6–7-merous (bacca drupa with (5–)6–7 pyrenes).
    3. Flowers fasciculate in the leaf axils. 35. *I. psammophila.*
    3. Flowers solitary.
      4. Leaf-blades less than 6.0 cm long. 7. *I. tiricae.*
      4. Leaf-blades more than 6.0 cm long.
        5. Flowers from lateral and axillary buds, usually 6-merous, occasionally 5-merous.
          6. Blades mostly obtuse at apex occasionally acute, acute or short cuneate at base; fruit globose or subglobose. 19. *I. marginata.*
          6. Blades usually acuminate at apex, long cuneate to spathulate at base; fruit ovoid-ellipsoid. 35. *I. psammophila.*
        5. Flowers all axillary, regularly 5-merous. 51. *I. ptariana.*
  2. Flowers (at least the perianth) mostly 4-sometimes 5-merous (bacca drupa with 4 or occasionally 5 pyrenes).
    7. Flowers all or mostly solitary, not forming an extended rachis.
      8. Flowering from lateral and axillary buds.
        9. Blade margins toothed, crenate, apex retuse, pyrenes 3–5-striatulate dorsally. 45. *I. retusa.*
        9. Blade margins entire, apex acuminate, acute, or rounded-obtuse, not or only rarely with retuse apex; pyrenes dorsally smooth or unicanaliculate.
          10. Pyrenes smooth; blades long-acuminate (3.0 mm or longer).
            11. Blades ovate or narrowly ovate, base acute or short-cuneate. 32. *I. macarenensis.*
            11. Blades obovate; base long-cuneate. 35. *I. psammophila.*
          10. Pyrenes unicanaliculate or unisulcate, with or without dorsal marginal ridges; blades short-acuminate or obtusely rounded at apex.
            12. Blades all or mostly less than 6.0 cm long. 7. *I. tiricae.*
            12. Blades all or mostly longer than 6.0 cm long.
              13. Pyrenes usually 5(4) of 2 kinds in each fruit, large and small with or without dorsal lateral ridges and with or without an appendage at one end; blades thinly coriaceous, and abruptly acuminate. 20. *I. sulcata.*
              13. Pyrenes 5 or 6 all of one kind in each fruit, narrowly trigonous, dorsally unicanaliculate, without ridges on the margins; blades thickly coriaceous, mostly obtusely rounded, if acuminate, not abruptly so. 19. *I. marginata.*
      8. All the flowers axillary.
        14. Margin of leaf-blade toothed. 55. *I. apicidens.*
        14. Margin of blade entire.
          15. Adult blades 7.5–9.1 cm long.
            16. Adult blades narrowly ovate occasionally broadly ovate. 51. *I. ptariana.*
            16. Adult blades all broadly ovate. 53. *I. glaucophylla.*

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[27] Hu, S-Y., The Genus *Ilex* in China, Jour. Arn. Arb. 31: 242. 1950.

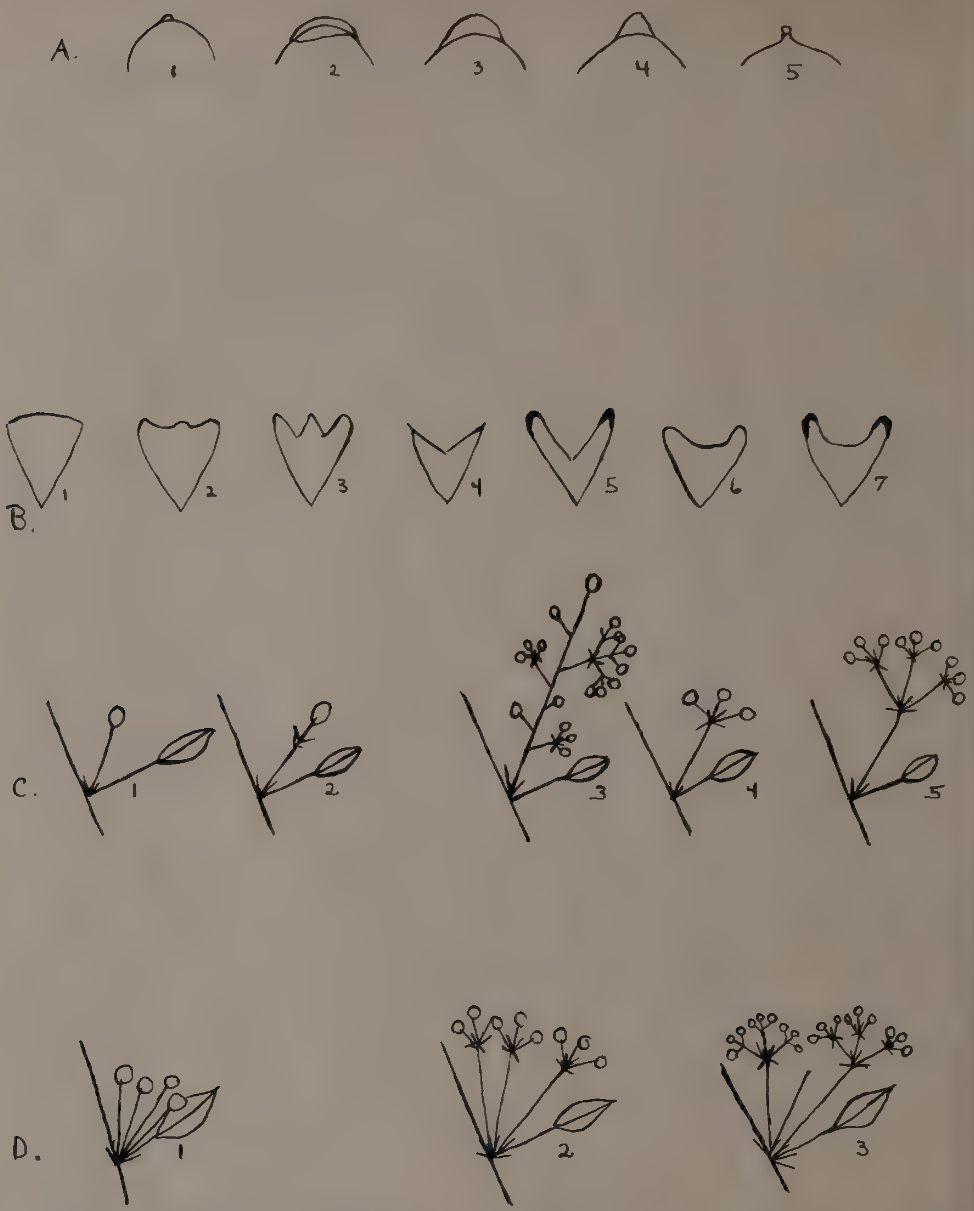

FIG. 26. Diagramatic Representations. A, Stigmas, 1 punctate, 2 capitate, 3 capitate-subcoronate, 4 coronate, 5 punctate on short style. B, Cross sections of pyrenes (seed) dorsal surface uppermost; 1 smooth, 2 3-striatulate-2-sulcatulate, 3 striate-sulcate, 4 deeply unisulcate, 5 deeply unisulcate with marginal ridges, 6 unicanaliculate, 7 unicanaliculate with marginal ridges. C, Solitary flowers and inflorescences; 1 solitary flower ♂ truly pedicellate, 2 solitary flower, ♀, peduncle and pedicel both present, falsely pedicellate, 3 central rachis well developed, racemose-paniculate inflorescence, 4 1x branched peduncle, 5 2x branched peduncle. D, Fasciculate flowers and inflorescences; 1 pedicellate flowers, 2 1x branched peduncles, 3 2x branched peduncles. C and D all axillary.

15. Adult blades not more than 6.4 cm long, usually less.

17. Adult blades up to 3.8 cm long mostly not exceeding 3.0 cm. 33. *I. vacciniifolia.*

17. Adult blades from 3.5–6.4 cm, mostly 4.5–5.8 cm.

18. Pyrenes 4; dorsally 3–5 striatulate, without ridges on the margins; petioles more than 5.0 mm long. 28. *I. parvifructa.*

18. Pyrenes 5; 2 kinds in each bacca drupa, 4 dorsally unisulcatulate without marginal ridges, laterally rounded, smooth, 1 dorsally unicanaliculate with marginal ridges; petioles less than or equaling 5.0 mm. 6. *I. uaramae.*

7. Flowers all or mostly fasciculate; or forming an extended rachis.

19. Blade margins all or mostly toothed.

20. Flowers from both lateral and axillary buds. 15. *I. jenmanii.*

20. Flowers all from axillary buds.

21. Seed dorsally (5–)7-striate, subsmooth to 2-striate laterally. 49. *I. martiniana.*

21. Seed dorsally unisulcate with one stria inside the sulcation; unistriate laterally. 15. *I. jenmanii.*

19. Blades all or mostly entire, occasionally with a few small teeth occurring at random on the margin.

22. Flowers from both lateral and axillary buds.

23. Base of blade acute or obtuse; petioles 6.0–12.0 mm long; some flowers on old wood. 37. *I. guianensis.*

23. Base of blade long-cuneate; petioles 9.0–20.0 mm long (mostly more than 12 mm long), flowers all on new wood. 35. *I psammophila.*

22. Flowers all axillary.

24. Petioles less than or equaling 5.0 mm long. 24. *I. oliveriana.*

24. Petioles more than 5.0 mm long.

25. Petioles 1.0–1.5(–2.3) cm long; adult blades mostly 8.5–9.5 cm long, broadly ovate, usually less than or up to about 2 × longer than broad. 49. *I. martiniana.*

25. Petioles not exceeding 1.1 cm long; adult blades mostly less than 8.5 cm long, usually not more than 7.5 cm long (if 8.5 cm or longer, then lance-elliptical or lance-ovate), mostly medium ovate (or narrower) or obovate or elliptical, usually more than 2 × longer than broad, 2.5–4.0 × longer than broad.

26. Pyrenes 4; 2 aborted, 2 fertile, ovoid-trigonous, all dorsally smooth; blades chartaceous. 34. *I. inundata.*

26. Pyrenes 4, or 4–6, all fertile, trigonous; blades coriaceous or thick-coriaceous.

27. Female flowers borne on pluri-fasciculate (5–9 or more) 1 × or frequently 2 × branched peduncles; blades mostly more than 7.5 cm long; lanceolate, lance-ovate, lance-elliptical, lance-obovate, ovate or obovate; pyrenes 4, dorsally 1–3-striatulate, never smooth. 14. *I. diospyroides.*

27. Female flowers borne on 2–3-fasciculate, 1 × or unbranched peduncles; blades up to 7.0 cm, but usually not exceeding 6.0 cm, ovate or elliptical; pyrenes dorsally smooth or 1–3-striatulate.

28. Flowers ca. 1.0 cm in diameter; stigmatic-lobes discoid, running down the ovoid-pyramidaloid bacca drupa ca. 2.0 mm; blades thick-coriaceous; pyrenes 4–6. 38. *I. theezans* var. *reidelii.*

28. Flowers ca. 4–6 mm in diameter; stigmatic-lobes wholly united, punctate or coronate; bacca drupa globose or subglobose; blades thin-coriaceous; pyrenes 4. 36. *I. umbellata.*

1. Leaf-blades punctate beneath.

29. Flowers fasciculate.

30. Blade-margins entire or almost so; occasionally with a few irregularly spaced subobsolete teeth over a part or all of the margin.

31. Flowering from both lateral and axillary buds.

32. Pyrenes dorsally 3–5-striatulate to sub-smooth, narrowly trigonous; blades broadly obovate, base cuneate-acute, apex mostly rounded (occasionally retuse), veins impressed above. 29. *I. neblinensis.*

32. Pyrenes dorsally unisulcate or unicanaliculate; blades ovate and rounded or obtuse at base, or spathulate-obovate with retuse apex, veins plane above.

33. Dorsal sulcation not median, pyrenes unequally and irregularly trigonous and dorsally, marginally without ridges; blades mostly spathulate-obovate, apex retuse. 18. *I. divaricata.*

33. Dorsal sulcation or canaliculation median, pyrenes regularly and equally narrowly or broadly trigonous, dorsal marginal ridges sometimes present; blades ovate, rounded or obtuse at base. 3. *I. amazonensis.*

31. Flowers all axillary.

34. Blades all or most less than 6.0 cm long.

35. Pyrenes dorsally smooth; all blades less than 6.0 cm long. 25. *I. bolivarensis.*

35. Pyrenes dorsally unicanaliculate; some blades more than 6.0 cm long. 9. *I. costata.*

34. Blades all or most 6.0 cm or longer.

36. Inflorescences racemose or paniculate, central rachis well developed, up to 3.0 cm long or longer. 50. *I. laureola.*

36. Inflorescences without a central rachis, flowers pedicellate or subumbelliform-pedunculate, peduncles up to 9-flowered.

37. Pyrenes 4–5, dorsally unicanaliculate or deeply unicanaliculate.

38. Blades mostly narrowly to broadly obovate (in var. *ovata* broadly ovate but less than 2 × longer than broad); ca. 9–12 pairs of lateral veins below. 30. *I. soderstromii.*

38. Blades ovate, 2 × longer than broad; ca. 6 pairs of lateral veins below.

39. Petioles more than 5.0 mm long. 22. *I. spruceana.*

39. Petioles less than 5.0 mm long (rarely equaling 5.0 mm). 9. *I. costata.*

37. Pyrenes 4, dorsally 3-striate and 2-sulcate, or 1–3-striatulate.

40. Pyrenes dorsally 3-striate and 2-sulcate; blades mostly broadly to narrowly ovate. 10. *I. fanshawei.*

40. Pyrenes dorsally 1–3-striatulate; blades mostly narrowly to broadly obovate. 46. *I. andarensis.*

30. Blade margin regularly toothed, over its entire length or in part, only rarely subentire.

41. Blades, all or most less than 6.0 cm long, petioles less than 5.0 mm long.

42. Blades ovate, not exceeding 3.2 cm long, mostly not over 2.5 cm long, margin dentate over entire length. 42. *I. kunthiana.*

42. Blades mostly lance-obovate, usually 4.0–5.8 cm long, mostly 4.5–5.3 cm long, margins distantly denticulate on upper 1/2 to 2/3. 31. *I. savannarum.*

41. Blades all or most more than 6.0 cm long; petioles 5.0 mm long or longer.

43. Extensive central rachis developed (up to 3.0 cm or longer), inflorescences racemose or paniculate. 50. *I. laureola.*

43. Extensive rachis not formed, flowers pedicellate or pedunculate, umbelliform or merely clustered.

44. Blades mostly exceeding 13.5 cm, elliptical. 54. *I. tateana.*

44. Blades not exceeding 9.5 cm long, narrowly ovate or obovate, or very broadly ovate.

45. Blades narrowly ovate to obovate, mostly 5.0–7.5(–8.3) cm long, 2 × or more longer than broad. 40. *I. conocarpa.*

45. Blades broadly ovate, mostly 7.0–9.0 cm long, less than 2 × longer than broad. 47. *I. yutajensis.*

29. Flowers all or mostly solitary.

46. Blade margins entire.

47. Flowers from both lateral and axillary buds.

48. Blades all or mostly 6.0 cm long or longer.

49. Specimen bearing mature fruit.

50. Pyrenes dorsally striatulate, subsmooth or smooth, neither marginal ridges nor appendages developed.

51. Pyrenes dorsally smooth or very lightly 3-striatulate, trigonous; petioles less than 5.0 mm long. 27. *I. solida.*

51. Pyrenes dorsally 3–5-striatulate to sub-smooth, narrowly trigonous; petioles more than 5.0 cm long. 29b. *I. neblinensis* var. *wurdackii.*

50. Pyrenes dorsally unicanaliculate or unisulcate never smooth, with or without marginal ridges or appendages.

52. Pyrenes dorsally without marginal ridges and unappendaged, all of one kind in each fruit.

53. Pyrenes laterally unicanaliculate; petioles all or almost all less than 5.0 cm long, much thickened; blades subsessile, broadly ovate, less than or up to ca. 2 × longer than broad; bacca drupa ca. 9.0 mm long × 6.0 mm in diameter. 21. *I. magnifructa.*

53. Pyrenes laterally smooth; petioles 6.0–9.0 mm long (or little longer), little or not at all thickened; blades narrow- to medium-ovate, usually more than 2 × longer than broad; bacca drupa ca. 6.5 mm long × 4.0 mm in diameter. 12. *I. tepuiana.*

52. Pyrenes dorsally with well developed marginal ridges or appendaged at one end, or both, of 1 or 2 kinds in each fruit.

54. Pyrenes all alike in each fruit; petioles less than 5.0 mm long. 11. *I. lasseri.*

54. Pyrenes all alike, or 2 kinds in each fruit; petioles all exceeding 5.0 mm.

55. Pyrenes 4 or 5, all alike with dorsal ridges on the margins, unappendaged, endocarp soft. 2. *I. sipapoana.*

55. Pyrenes 5, of 2 kinds in each fruit, 2 or 3 small, sterile, remainder broadly trigonous, fertile, all with dorsal marginal ridges and with or without an extension of these ridges (appendage) at one end, endocarp hard. 20a. *I. sulcata* var. *sulcata.*

49. Specimen male, flowering female, or vegetative (only male material of *I. tepuiana* and *I. neblinensis* var. *wurdackii* known).

56. Petioles all or mostly less than 5.0 mm long; lateral veins subobsolete beneath.

57. Calyx-tubes and pedicels puberulent, calyx-lobes ciliolate; branchlets drying black. 27. *I. solida.*

57. Calyx and pedicels glabrous; branchlets drying brown.

58. Blades obovate or cuneate-obovate. 11. *I. lasseri.*

58. Blades broadly ovate or elliptical-ovate. 21. *I. magnifructa.*

56. Petioles all or almost all more than 5.0 mm long; lateral veins below more or less apparent.

59. Blades, all or most, abruptly short-acuminate, acumen ca. 0.3–2.0 mm long, deltoid-triangular; veins much lighter (often yellowish) than tissue beneath. 20. *I. sulcata* var. *sulcata.*

59. Blades all or almost all without acumens, acute to obtuse, if acumen present, not abruptly formed nor deltoid-triangular; veins beneath concolorous with tissue.

60. Blades mostly broadly ovate, occasionally broadly obovate; petioles 1/4–1/6(–1/7) the length of the blade, little or not at all thickened, blade little or not at all decurrent; veins impressed above. 29b. *I. neblinensis* var. *wurdackii.*

60. Blades mostly narrowly to broadly obovate, rarely ovate, decurrent or not; petioles 1/7–1/12 (mostly 1/8–1/10) the length of the blade, thickened or not; veins plane above.

61. Petioles 5.2–8.0 mm long, much thickened; blade decurrent at least half way, often spathulate-obovate, or narrowly obovate or obovate. 12. *I. tepuiana.*

61. Petioles 8.5–19.0(–22.0) mm long, not at all thickened; blade obovate to broadly obovate, not decurrent, nor spathulate. 2. *I. sipapoana.*

48. Blades, all or most, shorter than 6.0 cm.

62. Petioles less than 5.0 mm long.

63. Blades ovate to broadly ovate, much less than 2 × longer than broad, not exceeding 2.5 cm, mostly less than 2.0 cm long. 43. *I. maguirei.*

63. Blades spathulate-obovate, 2 ×–3 × longer than broad (rarely more than 3 × longer than broad), more than 3.0 cm long, up to 5.8 cm long. 31b. *I. savannarum* var. *morichei.*

62. Petioles more than 5.0 mm long (*amazonensis, sulcata* and var. *pygmaea, sessilifructa, sipapoana, lymanii* and *neblinensis* known almost entirely from female fruiting material only).

64. Blades all or most, abruptly short-acuminate, acumen 0.3–2.0 mm long, either deltoid- or lance-triangular.

65. Blades broadly ovate, acumen lance-triangular, base rounded to obtuse; veins concolorous beneath; petioles much thickened; pyrenes 4, dorsally unicanaliculate, with or without marginal ridges, narrowly or broadly trigonous. 3. *I. amazonensis.*

65. Blades mostly variously obovate, acumen deltoid-triangular, base cuneate to acute; veins beneath (yellowish) much lighter than tissue; petioles little or not at all thickened; pyrenes 5, two kinds in each fruit, large and small, all dorsally unicanaliculate with marginal ridges, and with or without an appendage at one end. 20. *I. sulcata.*

64. Blades, all or most, rounded, obtuse, acute or retuse at apex, only rarely acuminate.

66. Blades all less than 6.5 cm long, only rarely exceeding 6.0 cm (then up to 6.2 cm), mostly less than 5.0 cm, almost all retuse at apex, broadly ovate or broadly obovate, less than 2 × longer than broad; pyrenes 4, 3–5-striate to subsmooth. 29a. *I. neblinensis* var. *neblinensis.*

66. Some of the blades (*not most*) exceeding 6.0 cm (a few up to 9.0 cm) long, mostly or frequently more than 5.0 cm, apices varying from acute to retuse (very rarely acuminate, but not abruptly so), mostly acute to rounded, occasionally short-retuse, narrowly to medium-ovate, variously obovate to elliptical, most or all 2 × longer than broad.

67. Blades broadly obovate, obovate, spathulate-obovate or cuneate-obovate (frequently 2 kinds on one branchlet), up to 9.5 cm long (mostly less); mature bacca drupa, when dry, light-brown to tan, 7.0 mm long × 6.0 mm in diameter; pyrenes 4 or 5, dorsally unicanaliculate with marginal ridges, endocarp soft. 2. *I. sipapoana.*

67. Blades obovate to subspathulate-obovate, not exceeding 6.5 cm, mostly 4.8–5.7 cm long, usually all blades the same on one branchlet.

68. Mature bacca drupa, when dry, red or black, 5.0 mm long × 3.0 mm in diameter; pyrenes 4, dorsally unicanaliculate, endocarp soft; leaf-apices frequently or mostly retuse. 1. *I. sessilifructa.*

68. Mature bacco drupa brown when dry, 8.5 mm long × 6.3 mm in diameter; pyrenes 5, dorsally unicanaliculate with marginal ridges, endocarp hard; leaf apices only very rarely retuse. 4. *I. lymanii.*

47. Flowers from axillary bud.

69. Petioles, all or most, more than 5.0 mm long.

70. Blades all or most more than 6.0 cm long. 22. *I. spruceana.*

70. Blades all or most less than 6.0 cm long.

71. Blades very broadly ovate to suborbicular mostly less than 2 × longer than broad (or on the same or different branchlets more than 2 × longer than broad, then petioles less than 5.0 mm long); pyrenes 4, unicanaliculate, unequally and unevenly trigonous. 5. *I. subrotundifolia.*

71. Blades ovate, obovate or elliptical, more than 2 × longer than broad.

72. Blades all or most more than 4.8 cm long (5.0–6.0 cm) rarely to 6.3 cm long; pyrenes 5, dorsally unicanaliculate with marginal ridges. 4. *I. lymanii.*

72. Blades all or most less than 4.3 cm long (in *I. steyermarkii* rarely up to 5.5 cm).

73. Blade mostly acute or short-acuminate at apex, occasionally rounded or retuse; pyrenes dorsally smooth, or deeply unicanaliculate with very large marginal ridges.

74. Blades narrowly obovate to subspathulate-obovate, mostly 2.5–2.8 × longer than broad; pyrenes dorsally smooth, without marginal ridges. 26. *I. steyermarkii.*

74. Blades mostly broadly obovate or ovate, ca. 2 × or 2.2 × longer than broad; pyrenes dorsally unicanaliculate with very large marginal ridges. 17. *I. culmenicola.*

73. Blades mostly retuse or rounded at apex, occasionally acute or acuminate; pyrenes (known only for *I. archeri*) 4, unisulcate or 3–5-striatulate, without marginal ridges.

75. Blades mostly 3.2–4.2(–4.5) cm long × 1.8–2.4 cm broad. 13. *I. archeri.*

75. Blades not over 2.8 cm long × 1.6 cm broad, mostly much smaller (pyrenes unknown). 39. *I. gleasoniana.*

69. Petioles all or most less than 5.0 mm long.

76. A few blades exceeding 6.0 cm, up to 6.5 cm, very broadly ovate with abrupt short-acumen at apex; pyrenes 4 or 5, dorsally unicanaliculate with small marginal ridges. 23. *I. duidae.*

76. All blades less than 6.0 cm long.

77. Blades broadly-ovate to suborbicular, almost always less than 2 × longer than broad; some petioles more than 5.0 mm; pyrenes 4, dorsally unisulcate or unicanaliculate, unevenly and unequally trigonous. 5. *I. subrotundifolia.*

77. Blades lanceolate to narrowly obovate, obovate, spathulate-obovate or occasionally narrowly ovate, more than 2 × longer than broad; petioles all less than 5.0 mm long.

78. Mature blades not exceeding 3.5 cm long, mostly less than 3.0 cm (rarely to 4.5 cm), base subspathulate or acute; pyrenes dorsally smooth, or unicanaliculate with large ridges on all margins; stigmas wholly sessile on fruit.

79. Pyrenes 4, dorsally smooth; blades obovate, margins little thickened and little revolute. 25. *I. bolivarensis.*

79. Pyrenes 4–5, dorsally unicanaliculate with very large marginal ridges on all sides; blades lanceolate, lance-obovate to obovate, margins much thickened, much revolute. 16. *I. venezuelensis.*

78. Mature blades usually more than 3.5 cm long, mostly 4.5–5.9 cm (rarely to 6.3 cm); base acute or spathulate, never obtuse (female specimens only; male *I. huachamacariana* unknown and male *I. savanarrum* var. *morichei* has fasciculate flowers).

80. Bacca drupa pedicellate, style 1–2 mm long; pedicels 12.0–16.0 long; pyrenes 5, dorsally unicanaliculate with marginal ridges; blade margins usually much thickened, much revolute. 8. *I. huachamacariana.*

80. Bacca drupa pedunculate, style lacking, pedicels less than 7.0 mm long; pyrenes not seen; blade margins little if at all thickened or revolute. 31b. *I. savannarum* var. *morichei.*

46. Blade margins toothed over part or entire length.

81. Flowers from both lateral and axillary buds.

82. Pyrenes dorsally 3–5-deeply striate; male inflorescence on basal peduncle not exceeding 8.0 mm long, usually 4.0–7.0 mm. 45. *I. retusa.*

82. Pyrenes dorsally 5–7-striatulate; blades chartaceous, apex mostly acute or acuminate; male inflorescence on basal peduncle 1.0–2.0 cm long, mostly ca. 1.7 cm long. 44. *I. karuaiana.*

81. Flowers all from axillary buds.

83. Blades all or most 6.0 cm or longer.

84. Apex mostly acuminate, acumen blunt, ca. 2.0–3.0 mm long, base short-acute to cuneate, not or little decurrent. 48. *I. casiquiarensis.*

84. Apex retuse or rounded to acute, very rarely acuminate, base acute to short-attenuate, usually decurrent. 40. *I. conocarpa.*

83. Blades all or most shorter than 6.0 cm.

85. Blades mostly longer than 2.6 cm.

86. Blades obovate to spathulate-obovate, apex retuse or acute, margins remotely toothed on upper 1/2 to 2/3. 31. *I. savannarum.*

    86. Blades ovate, apex abruptly sharply acuminate, margins closely toothed over entire length. 52. *I. cowanii.*
  85. Blades mostly shorter than 2.2 cm.
    87. Margins denticulate at apex only. 55. *I. apicidens.*
    87. Margins serrate-serrulate or dentate-denticulate over entire length.
      88. Blades broadly ovate, less than 2 × longer than broad, rounded to subcuneate at base; petioles much thickened. 42. *I. kunthiana.*
      88. Blades narrowly ovate or obovate, 2.0–2.2 × longer than broad, subspathulate, acute to acuminate at base; petioles little if at all thickened. 41. *I. myricoides.*

Ilex sect. **Guayanoilex** Edwin, sect. nov.

Mesocarpis plerumque largis aliquando mediis ad sublargis farinosis vel glutinosis; pyrenis dorsaliter unicanaliculatis vel unisulcatis; laminis subtus punctatis vel epunctatis.

The bacco drupa almost always is big for the genus. This condition and the copious mesocarp result in pyrenes that are only about average size. The ''U'' shaped or broadly ''V'' shaped dorsal surface of the pyrenes together with the foregoing are not found (to my knowledge) in any other *Ilices.*

The species in this section are sub-divided into two new subsections; one of the subsections is further divided into two new series (see below).

Ilex sect. **Guayanoilex** subsect. **Mixtigemmae** Edwin, subsect. nov.

Floribus femineis et gemmis mixtis basis racemose florigris apice foliatis et omnino florigris; foliis subtus punctatis.

1. **Ilex sessilifructa** Edwin, sp. nov.

Arbor parva, ramis ramulis et virgis in sicco nigris vel purpureo-nigris, sparses et inequaliter capillis nigris puberulis (ex parte lignis glabris); lamina sub-coriaceis glabris vel subtus costis capillis longis nigris pubescentibus vel costis et vena secundum inter eas pubescentibus, marginis integri non nunquam brevibus nigris ciliotis praeditis, apice plerumque acutis, retusis non nunquam subacutis retusis basibus acutis vel acutis subspathulatis in sicco supra lucide-brunneis vel brunneis viridis subtus pallidiore-brunneis vel brunneis viridis, punctatis, 4–6 jugis venorum subobsoletis vel obsoletis, 4.8–5.7(–6.5) cm longis × (1.6–)2.0–3.0(–3.2) cm brevibus, obovatis vel subspathulatis obovatis; ♀-floribus (ex fructu) solitariis, axillaribus pedicellatis gemmae omnino florigris, vel axillaribus vel lateralibus gemmae mixtis basi horotinis acutis singulatis aggregatis (falso subfasciculatis) et racemosis usque ad apicem foliatis, raro singulatis lateralibus, 4-meris, pedicellis brevissimis usque ad 6.0 mm plerumque 4.5 mm vel minus, calycis tubis puberulis lobis puberulis et ciliolatis ovatis marginibus subhyalinis apice acutis; baccis drupis in vivo et in sicco atroroseis ad roseopurpureis globosis ad subglobosis, parvis 4.5–5.0 mm longis × 3.0 mm diametro, laevis, stigmatis lobis ex parte confluentibus subcapitatis discoideis, mesocarpis in sicco farinosis roseis, largis; pyrenis 4 trigonis dorsaliter unicanaliculatis, stirpe ♂-et ♀-ignoti.

Type. Lowland and slope forests in *Clusia* tangle just S of Camp 3, alt. 650 m, Cerro de la Neblina, Río Yatua, Amazonas, Venezuela, 24 Jan 1954, *Bassett Maguire, John J. Wurdack & George S. Bunting 37361* (holotype US).

2. **Ilex sipapoana** Edwin, sp. nov.

Frutex vel arbor parva ad 8 m alta, subglabra, in sicco ramis griseis ramulis et virgis atrogriseis ad atrobrunneis vel nigris omnino glabris vel sparsis puberulis aliquando puberulis capillis brevibus nigris; laminis aliquando capillis brevibus nigris marginibus, subchartaceis ad coriaceis plerumque tenue-coriaceis, marginibus integris plerumque revolutis, apice plerumque orbicularibus humile-retusis non nunquam integris, raro profunde-retusis, non nunquam subacutis (raro acuminatis typico praeditis), basibus plerumque acutis ad cuneatis aliquando plus minusve subspathulatis, non vel tenuissime decurrentibus, in sicco supra lucide-atroviridis brunneis ad brunneis, 6–8 jugis venulorum plus minusve prominenter impressatis, subtus obscuro- vel viride-brunneis, venulorum subobsoletis, punctatis, roseis punctis, puncticulatis nigris puncticulis, magnitudis et formis laminis variabilis 2.9–9.9 cm longis × 1.6–4.8 cm latis, plerumque 6.2–8.5 cm longis × 2.4–3.8 cm latis, plerumque obovatis, ellipticis obovatis vel subspathulis obovatis aliquando ellipticis vel ovatis; petiolis plerumque non crassis, aliquando incrassatis plerumque 6.0–9.0 mm longis raro plus minusve; ♀-floribus omnibus pedicellatis subremote solitariis, axillaribus vel lateralibus, vel basi horotinis auctus congregari, gemmae omnino florigris vel gemmae mixtis florigris basim ramulis et apice foliis productibus frequenter solis foliis unico, juvenalibus falso fasciculatis, vel raro gemmae omnino florigris productibus lateraliter brevibus ramulis, 4–5(–6) meris, pedicellis glabris vel sparsis puberulis, 6.0–11.0 mm longis, calycis tubis glabris vel sparsis puberulis, aliquando puberulis lobis ovatis subobsoletis ca. 1.0 mm longis, apice acutis, puberibus similis tubis vel puberulis ciliolatis petalis 4–5(–6) ovatis in sicco marginibus subhyalinis, apice obtusis, staminodibus ovoideis subglobosis ovariis superantibus, 2.0–2.5 mm longis, filamentis 3–4 × lance-ovatis antheris; baccis drupis in sicco pallidis brunneis, rugulosis ca. 7.5–8.5 mm longis × 6.0–7.5 mm diametro, subglobosis ad late-ovoideis, stigmatis lobis confluentibus capitato-discoideis mesocarpis largis farinosis (in vivo glutinosis); pyrenis 4–5 angusteo- ad submedio-trigonis dorsaliter unisulcatis cristis marginibus, endocarpis mollis, ♂-floribus ignoti.

Type. In marsh in Camp Savanna, alt. 1500 m, Cerro Sipapo (Paraque), Amazonas, Venezuela, 15 Dec 1948, *Bassett Maguire & Louis Politi 27687,* female fruiting (holotype US). Paratypes. In wet low bush below lower Camp Savanna, alt. 1500 m, 15 Dec 1948, *Maguire & Politi 27724;* Caño Negro, alt. 1400 m, 25 Dec 1948, *Maguire & Politi 27995;* also 12–14 Jan 1948, in fruit, alt. 1800 m, *Maguire & Politi 27729, 28322, 28367;* upper Caño Negro, alt. 1600 m, 8 Jan 1949, *Maguire & Politi 28230,* female flowering.

3. **Ilex amazonensis** Edwin, sp. nov.

Arbor puberula 6–8 m alta, ramis in sicco atrogriseis nigris vel brunnescenti-griseis glabris vel sparsis puberulis, ramulis et virgis in sicco nigris puberulis vel dense-puberulis capillis nigris divisis vel indivisis; lamina subtus villosis (supra villulosis vel glabris) capillis nigris coriaceis ad incrassate-coriaceis, marginibus integris revolutis plus minusve dense-ciliatis-ciliolatis capillis nigris apicibus orbicularibus abrupte-breviacuminatis, acuminis acris lance-triangularibus, basibus plerumque obtusis, in vivo supra lucide-viridis, subtus obscurioribus pallidioribus in sicco supra lucide-viridis vel brunneis viridis, subtus brunneis-viridis ad brunneis, punctatis (punctis non nunquam capillis obscurantibus) 5.3–6.9 cm longis (rarissime paulo brevioribus) × 3.1–4.2 cm latis plerumque late- vel latissime-ovatis, aliquando suborbicularibus; petiolis 8.0–14.0 (plerumque 10.0–12.0) mm longis incrassatissimis, nigris; ♂-floribus fasciculatis pedunculatis plerumque axillaribus, 1 × divisis (3–5–)7–(–9) pedicellis aliquando lateraliter fasciculatis vel pedunculatis solitariis, floribus plerumque basim horotinum lignis gemmis plerumque omnino florigris, aliquando mixtis inflorescentiis racemosis ad basim floribus et apice foliatis, pedicellis in eas axillaribus vel plerumque lateraliter solitariis plerumque vel omnino 5-meris, raro 4-meris, pedunculis glabris vel subglabris 5.0–11.0 mm longis, pedicellis glabris vel subglabris 0.5–2.5 mm longis, calycis tubis et lobis glabris vel sparsissime-puberulis, eciliolatis, lobis ovatis triangularibus, apice acutis, petalis late-ovatis vel ovatis, marginibus sub-hyalinis, apice obtusis, antheris glabris ca. 2.0 mm longis filamentis latis (ca. 0.5 mm) coniunctis inter antheris lobis subovatis ad subulatis, extendentibus antheris et filamentis aequaliter longis, pistillodiis perreductibus ca. 0.4 mm longis plane-subglobosis ad apicem conicis, stigmatis lobis tenuibus subobsoletis, stirpe ♀ (ex fructu) 5-meris solitariis axillaribus pedunculatis pedunculis villosis ca. 1.0–1.2 cm longis 1 × divisis pedicellis triplis (raro quintis) villosis ca. 8.0–10.0 mm longis, calycis villosis tubis subcupliformibus, lobis 5 eciliolatis late ovatis obtusis; baccis drupis pyriformibus villosis in sicco nigris 7.0 mm longis × 6.0 mm diametro, stigmatis coronatis villosis lobis confluentis, exocarpis rugosis mesocarpis mediis glutinosis; pyrenis 4 anguste- ad late-trigonis, 3.5 mm longis dorsaliter unisulcatis vel unicanaliculatis non nunquam cristis marginalibus praeditis; ♀-floribus ignoti.

Type. Occasionally in upper Cañon Grande basin, male in flower, alt. 1900 m, Cerro de la Neblina, Río Yatua, Amazonas, Venezuela, *Bassett Maguire, John J. Wurdack & Celia K. Maguire 42347* (holotype NY). Paratype. Same data as holotype, female fruiting *42348*.

4. **Ilex lymanii** Edwin, sp. nov.

Frutex ad 4 m alta, ramis, ramulis et virgis in sicco atroroseis brunneis sparsis et brevipuberulis capillis albis; laminis glabris coriaceis vel subcoriaceis, marginibus integris revolutis, apice plerumque obtuse-orbicularibus retusis vel non nunquam acutis acuminibus brevissimis ca. 1.0 mm longis praeditis, basibus acutis vel cuneatis aliquando subspathulatis tenue-decurrentibus petiolis paulo incrassatis, in sicco supra lucide-brunneis vena secundum subobsoletis, subtus pallidis, punctatis, 5.1–5.6 cm longis × 2.1–3.5 cm latis, obovatis vel late-elliptice-obovatis; petiolis 8.0–11.0 mm longis glabris vel subglabris; ♀-floribus ex fructu solitariis non nunquam axillaribus florigris gemmis sed plerumque lateralibus basi ramulis axillaribus vel lateralibus mixtis gemmis productis infra inflorescentiae racemosis apice gradatim foliatis praeditis 5- vel raro 6-meris pedicellis puberulis ca. 5.0–7.0 mm longis, calycis puberulis tubis parvis orbicularibus 5 (raro 6) lobis parvissimis deltoideis triangularibus ciliolatis usque ad 1.0 mm longis × 1.0 mm latis plerumque minioribus ca. 0.3 mm longis × 0.4 mm latis; baccis drupis in sicco pallidis brunneis 8.5 mm longis × 6.5 mm diametro, laevis ad leviter rugulosis globosis, stigmatis punctatis coronatis, mesocarpis largissimis farinosis (in vivo glutinosis); pyrenis 5 trigonis dorsaliter unicanaliculatis cristis marginalibus, endocarpis duris; stirpe ♂- et ♀-ignoti.

Type. Infrequent, alt. 1800 m, Cerro Guanay, Amazonas, Venezuela, 2 Feb 1951, *Bassett Maguire, Richard S. Cowan & John J. Wurdack 31721* (holotype US).

5. **Ilex subrotundifolia** Steyermark, Fieldiana Bot. **28**: 328. *fig. 61*, 1952.

Ilex brevipetiolata Steyermark & Wurdack, Mem. N. Y. Bot. Gard. 9: 479. *fig. 119*, 1957.

Distribution. Savanna and swampy savanna (Río Tirica), Composite Swamp (*Chimantaea mirabilis*), rocky elevations in savanna and cumbres. VENEZUELA. Kavanayen, Río Karuai Ilu-tepuí, Chimantá Massif, central section and east-central portion of summit of Apácara-tepuí; Auyan-tepuí; Cerro Uaipan, Río Caroni, Cerro Orepuchi; Cerro Sipapo at alt. 1220–2500 m.

Ilex sect. **Guayanoilex** subsect. **Florigemmae** Edwin, subsect. nov.

Floribus femineis omnibus axillaribus; laminis subtus punctatis vel epunctatis.

Ilex sect. **Guayanoilex** subsect. **Florigemmae** series **Axillariae** Edwin, series nov.

Floribus femininis omnibus axillaribus.

6. **Ilex uaramae** Edwin, sp. nov.

Frutex 2 m alta, ramis subglabris, in sicco griseonigris, ramulis et virgis puberulis vel leviter puberulis, in sicco nigro coloratis purpureis; laminis coriaceis, glabris, apice breviacuminatis, acuminis minus 0.5 mm longis, basis acutis, cuneatis vel subspathulatis, in vivo supra atroviridis, subtus pallidis, epunctatis, in sicco supra viridis vel brunnescenti-viridis, subtus pallidis brunneis, venis valde pallidior quam lamina (sufflavis), 2.8–4.8(–5.4) cm longis × 1.6–2.2 cm latis obovatis ad subspathulatis obovatis, petiolis usque ad 5.0 mm longis, aliquantum incrassatis, puberulis; floribus axillaribus, solitariis, aliquando breva ramula formanantibus (ramulis floribus racemosis praeditis, singulis ex axillaribus orientibus) gemmis secundariis foliis exacte, floribus pedicellatis vel 2–3 pedunculatis; pedunculis brevibus usque ad 3.0 mm longis, pedunculis nullis pedicellis usque ad 5.0(–6.0) mm longis quando pedunculis praeditis usque ad 3.0 mm longis, uterque puberulis; baccis drupis in sicco brunneis, rugulosis, 5.0 mm longis × 6.0 mm diametro, subglobosis, stigmatis discoideis, ex parte confluentibus, calycislobis 5, glabris vel subglabris, acutis, mesocarpis glutinosis, mediis ad sublargis; pyrenis 5 in sicco roseis vel brunneis, in fructo unico dimorphiis, 4-trigonis dorsaliter unisulcatulatis sine cristis marginibus, lateraliter rotundatis, ventraliter obtusis, 1 anguste-trigonis dorsaliter unicanaliculatis cristis marginibus; stirpe ♂ et ♀ ignoti.

Type. Vicinity of road campamento, 150 km in valley of savanna of Río Uarama tepuí, NE of Tuepa, alt. 1220 m, Bolívar, Venezuela, 24–25 April 1960, *Julian A. Steyermark & Sven Nilsson 557* (holotype VEN).

7. **Ilex tiricae** Edwin, sp. nov.

Frutex subglabra 0.5–1.0 m alta, ramis ascendentibus, ramulis et virgis in sicco griseis, atrogriseis vel nigrogriseis solum sparsissimis puberulis (cum pedicellis) vel glabris (cum calycis); laminis rigidis coriaceis, glabris, marginibus integris, vel aliquando 1/8–2/3 marginibus remote serrulatis, revolutis, apice abrupte brevissime ad breviacuminatis, acuminibus 0.1–2.5 mm longis, deltoideis-triangularibus, basibus cuneatis vel orbicularibus non vel solum parvum decurrentibus, in vivo supra atro-viridis et lucidis, subtus argenteo-viridis, in sicco supra lucide-

brunnescenti-viridis, subtus pallidis obscuris viridis brunneis, epunctatis (vel rarissimo sub lente 30 × sparsissime puncticulatis) supra et subtis 7–9 jugis venarum subobsoletis, alternariis, (2.0–)3.6–5.3(–6.1) cm longis × (1.6–)3.1–3.5(–3.8) cm latis, plerumque late ovatis aliquando ovatis raro obovatis; petiolis in sicco nigris incrassatis 7.0–12.0 mm longis (plerumque 7.0–10.0 mm); ♀-floribus (ex fructu) solitariis, axillaribus in pedicellis tenuibus praelongis, 1.4–2.4 cm descendentibus, 6-meris, calycis tubis circulo nigro saepe reductis, calycis-lobis 6, parvissimis acutis; baccis drupis in sicco (et in vivo) castaneis brunneis ad mahogoniis, exocarpis laevis roseis vel nigris punctis, ca. 10.0 mm longis × 7.0 mm diametro late-ovoideis ad subglobosis, apice acutis, stigmatis lobis 6 ex parte confluentibus, capitatis-coronatis, mesocarpis largis in sicco farinosis, in vivo glutinosis; pyrenis 6, trigonis late-canaliculatis cristis marginibus dorsaliter, laevis lateraliter; ♂- et ♀-floribus ignoti.

Type. Shrubby thickets bordering swamp along E branch of headwaters of Río Tirica, alt. 2120 m, Central Section of Chimantá Massif, Bolívar, Venezuela, 12 Feb 1955, *Julian A. Steyermark & John J. Wurdack 803* (holotype US; isotype VEN).

8. **Ilex huachamacariana** Edwin, sp. nov.

Frutex magna vel arbor, ad 8 m alta, ramis in sicco atrogriseis-nigris, ramulis et virgis nigris vel atrorubro-brunneis omnibus sparsis ad subdense puberulis, laminis pervariabilibus, tenui ad crasse coriaceis, plerumque glabris vel supra non nunquam capillis nigris subaequaliter vestitis costis et textibus, marginibus integris plus minusve ciliolatis plus minusve crassis, apice plerumque acutis dein retusis vel subrotundatis retusisque, non nunquam acutis vel suborbicularibus integris, basibus acutis subspathulatis vel attenuatis, raro cuneatis, rarissimo obtusatis, plerumque ad petiolum ex parte decurrente, aliquando omnino vel non decurrente, in vivo supra atrolucide viridis, subtus obscuris, pallidioribus, punctatis, in sicco supra viridis ad atrobrunnescentibus, subtus pallidis brunnescenti-viridis, 2.1–6.5 cm longis × 0.8–2.5 cm latis, typo plerumque ca. 4.4–5.5 cm longis × 1.4–1.9 cm latis, plerumque anguste-obovatis non nunquam obovatis, minus saepe spathulato-obovatis vel ellipticis; petiolis plerumque 2.8–4.9 raro ad 6.0 mm longis, incrassatis, puberulis; floribus et inflorescentiis solitariis, plerumque axillaribus, aliquando ♂ lateralis, ♀ (ex fructo) pedicellatis, 5–(raro 6) meris, floribus ♂ pedunculatis, 3–5(–7) inflorescentia parva racemosa formata, raro ♂ solitariis pedicellatis, pedunculis et pedicellis solitariis ♀ 0.5–1.6 cm longis, plerumque 0.8–1.3 cm, ♂ inflorescentiae pedunculis 1.0–1.8 cm longis, plerumque 1.3–1.5 cm, pedicellis ♂ ca. 1/2–1/3 pedunculorum aequantibus, pedicellatis lateralibus ♂ eas ♀ aequantibus, calycis-tubis puberulis, lobis puberulis, ciliolatis apice acutis vel obtusatis, ca. 1.4–1.8 mm latis, in stirpe ♂ staminibus ca. 4.5 mm longis, filamentis tenuissimis, ca. 3.7 mm longis, antheris subulatis, ca. 0.8 mm longis × ca. 0.5 mm latis, pistillodiis conicis, apice attenuatis, stigmatis lobis subobsoletis, stirpe ♂ ca. 5.5–7.8(–8) mm lato; stirpe ♀ ignoto; baccis drupis (in vivo atroroseis) in sicco atroroseis vel brunnescenti-roseis, subglobosis ad globosis ca. 7.0–9.5 mm longis × 7.0–8.0 mm diametro, rugulosis, stylis 0.2–1.2 mm longis, fere semper praeditis, stigmatibus punctatis vel subdisciforme-coronatis, endocarpis in vivo glutinosis, in sicco farinosis ad subglutinosis, largis, pyrenis 5, trigonis, dorsaliter profunde unicanaliculatis, jugis cristarum magnarum marginalibus praeditis, lateraliter laevibus vel unisulcatis, ventralis acris striatis, endocarpo duro.

Type. Small tree near Cumbre Camp, alt. 1800 m, fruiting, Cerro Huachamacari, Río Cunucunuma, Amazonas, Venezuela, 6 Dec 1950, *Bassett Maguire, Richard S. Cowan & John J. Wurdack 30027*. Paratypes. Cerro Huachamacari: vicinity of Summit Camp, alt. 1800 m, 6 Dec 1950, *Maguire, Cowan & Wurdack 30004;* ditto, 14 Dec 1950, *Maguire, Cowan & Wurdack 30201, 30237;* Elfin Forest, vicinity of Summit Camp, alt. 1800 m, 10 Dec 1950, *Maguire, Cowan & Wurdack 30100;* woodland in vicinity of camp, 16 Dec 1950, *Maguire, Cowan & Wurdack 30266, 30267 & 30268;* marshy scrub savanna near SE escarpment, alt. 1900 m, 11 Dec 1950, *Maguire, Cowan & Wurdack 30156*.

9. **Ilex costata** Edwin, sp. nov.

Frutex 2 m alta, ramis puberulis vel glabris, ramulis, virgis, pedunculis, pedicellis et calycis puberulis, lignis horotinis leviter striatulatis sulcatulatis vel laevis; in sicco ramis et ramulis griseis ad atrogriseis, virgis atroroseis; laminis coriaceis ad incrassatis coriaceis glabris vel aliquando basi pauci capillis mollis, marginibus integris, apice breviacuminatis vel acutis raro obtuse-rotundatis, basibus acutis vel cuneatis raro obtusis supra lucide-viridis ad atroviridis costis vix impressis prominenter venulosis subtus punctatis ad sparsis punctatis pallidis viridis ad sufflavis vel brunnescenti-viridis, costis prominenter elevatis, 9–12 jugis venularum subprominenter (3.0–)3.8–6.5(–7.9) cm longis × (2.0–)2.5–3.7(–4.4) cm latis ovatis late-ovatis obovatis late-obovatis vel ellipticis; petiolis brevissimis 1.0–5.0 mm longis plerumque 2.0–3.5 mm longis incrassatis (ca. 3.0 mm diametro) glabris vel puberulis capillis mollis albis, ca. 1/14–1/22 × plerumque ca. 1/17 × aequantibus laminis vix decurrentibus; inflorescentiis axillaribus fasciculatis ♂ inflorescentiis pluri-fasciculatis pedunculis 3.0–6.0 mm longis plerumque 1 × divisis (aliquando 2 × divisis raro indivisis) pedicellis triplis, quintis vel septis 1.0–2.0 mm longis (in 2 × divisis pedunculis intermediis 0.3–0.8 mm longis) floribus 4–5 meris, calycis ca. 1.8–2.5 mm longis, lobis et tubis subaequantibus lobis ciliolatis aliquando dense ciliolatis corolla longioribus quam calycis ca. 2.7 mm longis marginibus petalarum integris laciniatis vel undulatis vix brevioribus staminibus, antheris ca. 1/4 × vix incrassatis filamentis aequantibus pistillodiis ovoideis deltoideis, stigmatis lobis laciniatis apice depressis; ♀-inflorescentiis plerumque omnino pedicellatis floribus 4–7 fasciculatis, pedicellis 1.0–2.5 mm longis (aliquando floribus solitariis) calycis et corollis aequantibus ♂, staminodiis brevibus ca. 1.5 mm longis, ovariis ovoideis stigmatis sub-coronatis confluentibus; baccis drupis roseis globosis rugulosis, stigmatis lobis confluentis punctatis, mesocarpis farinosis largis; pyrenis 4–5 trigonis, dorsaliter profunde unicanaliculatis, subligneis.

Type. Occasionally in scrub savannah, alt. 1100 m, fruit subglobose, green, Wenamu Trail, Samwarakina-Tipu (Holi Tipu), Kamarang River, Pakaraima Mountains, British Guiana, 10 Nov 1951, *Bassett Maguire & D. B. Fanshawe 32523* (holotype US). Paratypes. British Guiana: Pakaraima Mountains, Upper Mazaruni River Basin, Chenowieng to Chi-Chi Landing, 1000 m alt., female flowering, 10 Nov 1955, *Maguire 40667;* ditto, male flowering, *Maguire 40651;* Chenowieng Village, scrub savannah about sandstone outcrop, frequent on trail, 747 m alt., male flowering, *Maguire & Fanshawe 44883;* on trail to Ayanganna, alt. 747 m, fruiting, *Maguire & Fanshawe 44913*.

10. **Ilex fanshawei** Edwin, sp. nov.

Frutex vel arbor parva ad 3 m alta, glabris ramis et ramulis subrectis in sicco ramis atrogriseis ramulis et virgis atroroseis striatulatis; laminis glabris coriaceis, marginibus integris incrassatis revolutis, apice plerumque acutis non nunquam orbicularibus vel retusis aliquando breviacuminatis, basibus acutis vel cuneatis raro obtusis, supra lucide- vel pallide-viridis venulosis subobsoletis subtus brunnescenti-viridis, punctatis, 7–9 jugis venularum plus minusve elevatis, (4.2–)5.3–9.1(–11.4) cm longis × (2.3–)2.8–4.2(–4.5) cm latis raro brevioribus vel longioribus, obovatis late-ellipticis ovatis raro ovatis; petiolis striatis incrassatis 0.7–1.4 cm longis, plerumque 1.1–1.3 cm longis glabris ca. 1.3–1/10 laminis aequantibus (plerumque 1/4–1/6); inflorescentiis fasciculatis axillaribus ♂ pluri-fasciculatis pedunculis puberulis vel glabris 2.0–6.0 mm longis 1 × divisis (raro 2 × divisis intermediis pedunculis subobsoletis) pedicellis duplis ad quintis (raro septis) glabris vel raro puberulis 1.0–2.0 mm longis; ♂ floribus 4-meris (raro 5-meris) calycis lobis ciliolatis deltoideis acutis ca. 0.5–1.0 mm longis tubis aequantibus lobis puberulis vel glabris petalis ca. 2.5 mm longis, in sicco incrassatis roseis marginibus subhyalinis (in vivo viride-albis), staminibus paulo brevoribus quam petalis filamentis ca. 1.3 mm longis ca. 3 × longis antheris subulatis pistillodiis ovoideis apice deltoideis stigmatis subobsoletis; ♀-inflorescentiis (ex fructu) pauci-fasciculatis raro pedunculatis 2-floribus, plerumque pedicellatis calycis 4–5 lobatis lobis brevibus vel aliquando obsoletis tubis et lobis puberulis vel glabris vel lobis ciliolatis; baccis drupis (juvenalis viridis) in sicco atro-roseis vel roseo-purpureis, rugosis ca. 4.0 mm longis × 5.0 mm diametro, stigmatis punctatis, mesocarpis largis farinosis roseis; pyrenis 4 vel 5 trigonis dorsaliter profunde unicanaliculatis ca. 2.5 mm longis × 1.8 mm latis, ligneis.

Type. Occasionally in savannah woodland (bush island), ♂ flowers greenish-white, Kaieteur Plateau, British Guiana, 3 May 1944, *Bassett Maguire & D. B. Fanshaw 23184* (holotype US). Paratypes. British Guiana: fruit green, 2 May 1944, *Maguire & Fanshawe 23146;* Kamarang River-Wenamu Trail, Kamarang Station, Kaietur Plateau, alt. 500 m, young fruit green, 13 Nov 1951, *Maguire & Fanshawe 32067;* Kaieteur Falls and Escarpment, alt. 400 m, flowers red, 15 Feb 1955, *Maguire 40691.*

11. **Ilex lasseri** Edwin, sp. nov.

Arbor subglabra, ramis, ramulis et virgis in sicco brunneis ad atrobrunneis paucis capillis sparsis albis; laminis glabris coriaceis ad incrassatis coriaceis, marginibus integris revolutis, apice rotundatis acutis vel obtusis, basibus attenuatis spathulatis vel raro subspathulatis omnino petiolis brevibus decurrentibus, in sicco supra lucide-viridis ad brunnescenti-viridis, subtus pallidis obscuris sufflavis viridis, punctatis, (5.5–)7.0–9.1 cm longis × 2.2–4.2 cm latis, obovatis, cuneatis obovatis vel aliquando elliptice-obovatis; petiolis glabris, incrassatissimis 3.8–5.0(–6.0) mm longis; ♀-floribus (ex fructu) probabiliter solitariis (solus unus vidi) 4-meris pedicellis ca. 2.3 cm longis glabris, calycis-lobis glabris; bacco drupis in sicco (et in vivo) roseis, laevis ovoideis ca. 7.0 mm longis × 4.0 mm diametro, stigmatis lobis confluentibus subcoronatis, mesocarpis largis, farinosis; pyrenis 4, trigonis dorsaliter unicanaliculatis, cristis marginibus, ca. 5.0–6.0 mm longis × 1.8 mm latis, subligneis, ♂- et ♀-floribus ignoti.

Type. Oparuma woods, Kavanayen, Venezuela, 28 May 1946, *Tobías Lasser 1827* (holotype NY).

12. **Ilex tepuiana** Steyermark ex Edwin, sp. nov.

Arbor ad 10.0 m alta, ramis in sicco griseis ad atrobrunneis, ramulis et virgis atroroseis vel nigris omnino glabris, laminis subcoriaceis vel coriaceis glabris, margibus integris plus minusve revolutis, apice pervariabilibus plerumque breviacuminatis non nunquam acutis vel acutis retusisque ad obtusis suborbicularibus, basibus cuneatis ad subspathulatis, omnibus decurrentibus petiolis, in sicco supra atroviridis ad atrobrunneis, subtus pallidioribus viridis ad brunneis punctatis, in vivo supra atroviridis subtus pallidis viridis, (4.6–)5.1–7.1(–7.8) cm longis × (2.3–)2.5–4.1(–4.4) cm latis plerumque lanceolatis obovatis ad late-obovatis, non nunquam ellipticis; petiolis incrassatissimis brevibus 2.0–5.0 mm longis glabris; inflorescentiis solitariis, ♀-floribus ex fructu glabris 4-meris, axillaribus, solitariis, pedicellatis, pedicellis glabris 8.0–20.0 mm longis plerumque 12.0–18.0 mm longis; calycis raro sparsissimis puberulis, lobis acutis; ♂-floribus 4-meris axillaribus et lateralibus, pedunculatis pedunculis puberulis ca. 6.0 mm longis 1 × vel 2 × divisis triplis ad septis puberulis pedicellis ca. 2.0–3.0 mm longis praeditis, calycis puberulis 4-lobis ciliolatis, petalis ovatis apice orbiculatis staminibus 4 subulatis, filamentis brevibus, pistillodiis ovoideis brevibus stylis praeditis; baccis drupis subglobosis ovoideis, in sicco nigris, stigmatis capitatis-subcoronatis, mesocarpis largis in sicco farinosis in vivo glutinosis; pyrenis 4 dorsaliter profunde unicanaliculatis.

Type. On mesa between Ptari-tepuí and Sororopán-tepuí, 1600 m alt., ♀ fruiting, Bolívar, Venezuela, 15–17 Nov 1944, *Julian A. Steyermark 60290* (holotype F). Paratypes. Bolívar: Chimantá Massif, ♀ fruiting, 21 May 1953, *Steyermark 75509*. British Guiana: Partang River, Merume Mountains, 470 m alt., 23 June 1960, *Maguire & Maguire 45915*.

13. **Ilex archeri** Edwin, sp. nov.

Frutex 1.5–3.0 m alta, villosis vel villulosis capillis nigris mollibus, ramis ramulis et virgis in sicco brunneis vel roseis nigris, pubescentiis pervariabilibus villosis vel villulosis; laminis subcoriaceis ad coriaceis plus minusve subtus villosis villulosis (costis, vena secundum et inter eas) costis maxime, marginibus integris revolutis ciliolatis capillis nigris, apice orbicularibus obtusis vel sub acutis raro retusis, basis acutis vel cuneatis raro subspathulatis, tenue in incrassatis petiolis decurrentibus 1/2 vel plus, in vivo supra lucide-viridis, subtus pallidis obscuris in sicco brunnescenti-viridis subtus punctatis, 3.2–5.3 cm longis × 1.8–2.6 cm latis obovatis raro elliptice-obovatis vel ellipticis, 5 jugis venulorum visibilibus supra impressa; petiolis villulosis plerumque 5.5–9.0 mm longis; ♀-floribus (ex fructu) solitariis, axillaribus 4–5-meris pedicellis incrassatissimis glabris vel sparsis puberulis 6.0–8.0 mm longis, calycis villosis lobis 4 vel raro 5 subobsoletis; baccis drupis in sicco pallidis brunneis subglobosis vel ovoideis apice angustissimis, rugulosis ca. 8.0 mm longis × 6.5 mm diametro, stigmatis coronatis villosis vel glabratis, mesocarpis tenue ad submediis, farinosis; pyrenis 4 trigonis dimorphiis in fructo unico, dorsaliter unisulcatis vel dorsaliter 3–5-striatis, 4.0 mm longis × 2.0 mm latis; stirpe ♂- et ♀-ignoti.

Type. Occasionally on upper slopes below NW escarpment between Camp 4 and Cumbre Camp, alt. 1500–1700 m, bushy shrub 1.5–3 m, fruit green, Cerro de la Neblina, Río Yatua, Amazonas, Venezuela, 13 Jan 1954, *Bassett Maguire, John J. Wurdack & George S. Bunting 37283* (holotype US).

14. **Ilex diospyroides** Reiss., Fl. Bras. **11**(1) : 47. *t. 14, fig. 15,* 1861.

Distribution. River banks, margins of savannas and edge of wet forest. VENEZUELA. Río Cuao, Río Orinoco, Río Siapa, Sta. Elena, Ikabaru, near Río Casiquiare at alt. 129–900 m.

15. **Ilex jenmanii** Loes., Nova Acta Acad. C. L. C. G. Nat. Cur. **78**: 412. 1901.

Distribution. River banks, margins of savannas, at forest edge and in savannas. BRITISH GUIANA. Kaieteur Plateau, Upper Mazaruni River Basin, Southern Pakaraima Mountains and near Demerara. VENEZUELA. Chimantá Massif, Altiplanicie de Nuria and (at Brazilian Border) Territorio Río Branco-Estado Bolívar at alt. 385–1000 m.

16. **Ilex venezuelensis** Steyermark, Fieldiana Bot. **28**: 330. *fig. 62,* 1952.

Distribution. Ridge tops, escarpment edges and northeast and southeast facing slopes. VENEZUELA. Cerro Duida; Chimantá Massif, Apacará-tepuí; Cerro de la Neblina, Río Yatua at alt. 1800–2200 m.

17. **Ilex culmenicola** Steyermark, Fieldiana Bot. **28**: 322. 1952.

Distribution. VENEZUELA. Cerro Duida at alt. 1800–1950 m.

18. **Ilex divaricata** Martius ex Reiss., Fl. Bras. **11**(1): 57. *t. 13, fig. 5,* 1861.

Distribution. Stream banks, escarpments, *Rubiaceae* Forest and *Araracuara*-type Savanna. VENEZUELA. Kavanayen, Cerro Duida, Río Cunucunuma; San Fernando de Atabapo, Río Orinoco opposite mouth of Río Atabapo; Ríos Pacimoni, Yatua, Casiquiari. COLOMBIA. Río Caquetá. BRAZIL. Alto Amazonas near Río Negro near Barra at alt. 100–2300 m.

Ilex sect. **Guayanoilex** subsect. **Florigemmae** series **Lateraliae** Edwin, series nov.

Floribus femineis uterque axillaribus et lateralibus.

19. **Ilex marginata** Edwin, sp. nov.

Arbor 6–8 m alta, ramis, ramulis et virgis in sicco purpureoatris griseis vel nigrescentibus, glabris striatis, cortice non nunquam lamelliformi, laminis incrassatissime coriaceis plerumque glabris sed non nunquam subtus capillis longis nigris et marginibus integris valde revolutis incrassatis, apicibus variabilibus acuminatis vel acutis ad rotundatis vel retusis, basibus plerumque cuneatis, non nunquam subspathulatis, omnino petiolis incrassatis decurrentibus in sicco supra lucide-atroviridis ad brunneis viridis ad brunneis, subtus pallidioribus, epunctatis (in vivo supro lucide-viridis, subtus pallidioribus, obscurioribus vel argenteo-viridis), (6.0–)7.5–10.5 cm longis × (3.3–)3.7–4.2(–4.5) cm latis, plerumque ovatis vel elliptico-ovatis vel sublate-ovatis, vel ellipticis, non nunquam obovatis vel spathulatis obovatis; petiolis glabris (8.0–)11.0–14.0(–16.0) mm longis; ♀-floribus (ex fructo) solitariis axillaribus vel lateralibus, (4–)5-vel 6-meris, calycis (4–)5- vel 6-lobatis, lobis deltoideis triangularibus acutis vel obtusis, pedicellis 7.0–20.0 mm longis plerumque 12.0–17.0 mm longis, glabris; baccis drupis grandissimis ovoideis globosis ad subglobosis cum vel sine apice acutis, 6.0–10.0 mm longis (plerumque 8.0–9.0 mm) × 7.0–12.0 mm diametro (plerumque 8.0–9.0 mm), in sicco rugulosis ad rugosis, brunneis ad atrobrunneis, in vivo obscuris roseis (ad brunneis?), stigmatis lobis (4–)5–6, parvis ad modice confluentibus capitatis ad coronatis, mesocarpis largissimis, in vivo glutinosis, roseis, in sicco farinosis flavis; pyrenis (4–)5–6, angusteo-trigonis ad trigonis dorsaliter humile unicanaliculatis, plerumque sine cristis marginibus aliquando cristis parvis apice vel

secundo margine ex parte praeditis, 1.2–5.0 mm longis × 0.5–1.5 mm latis (plerumque ca. 2.3–4.8 mm × 0.8–1.2 mm), ♂- et ♀-floribus ignoti.

Type. Above first line of sandstone bluffs, alt. 2125–2300 m, Chimantá Massif, NW part of summit of Abacapa-tepuí, Bolívar, Venezuela, 14 April 1953, *Julian A. Steyermark 74993* (holotype NY; isotype VEN). Paratypes. Venezuela, Bolívar: in lower mixed *Bonnetia* forest above SE facing upper shoulder on slope leading to summit of Apácara-tepuí, alt. 2000–2150 m, 20 June 1953, *Steyermark 75826;* Chimantá Massif, central section, open forested lateral slopes along tributary of E branch of headwaters of Río Tirica, alt. 2185–2210 m, 13 Feb 1955, *Steyermark & Wurdack 866; Bonnetia* swale along creek just E of W branch of headwaters of Río Tirica, 11 Feb 1955, *Steyermark & Wurdack 734.*

20. **Ilex sulcata** Edwin, sp. nov.

Arbor ad 9 m (vel frutex ad 2 m) alta, ramis griseis, glabris, ramulis et virgis in sicco nigris vel atrobrunneis sparsis puberulis vel glabris; laminis, tenue coriaceis ad coriaceis, glabris, marginibus integris, apice abrupte acuminatis, acuminibus 0.3–2.0 mm longis, deltoide-triangularibus, basibus acutis cuneatis ad subspathulatis, in vivo supra atroviridis, subtus pallidis ad argenteoviridis, plerumque puncticulatis, venulis prominenter elevatis frequenter sufflavis, valde manifestissime, 2.8–7.2(–8.3) cm longis × 0.9–3.9 cm latis, plerumque anguste-obovatis, raro late-obovatis, saepe subspathulate-obovatis, non decurrentibus glabris, parvis incrassatis, 6.9–11.0(–14.0) mm longis petiolis; ♀-floribus (ex fructo) solitariis, axillaribus vel lateralibus; pedunculis (4.0–)6.0–9.0(–11) mm longis, glabris; baccis drupis globosis, 8.0–11.0 mm longis × 7.0 mm diametro, in sicco atrobrunneis ad pallidis brunneis (in vivo atroroseo-brunneis) laevis, stigmatis subcoronatis a discoide, lobis ex parte confluentibus, mesocarpis glutinosis, mediis; calycis 5-meris, glabris, lobis ovatis, apice acuta, marginibus subhyalinis; pyrenis 5, 2 in fructa unico dimorphiis, (2–)3 (aliquando 4) anguste-trigonis, dorsaliter late canaliculatis, alteri late-trigonis, anguste-canaliculatis vel unisulcatis, jugis cristarum magnarum marginalibus praeditis cristis apice plus minusve productis; stirpe ♂- et ♀-ignoti.

20a. **Ilex sulcata** Edwin var. **sulcata.**

Laminis (4.0–)6.1–7.2(–8.3) cm longis × 1.0–3.9 cm latis.

Type. East of west branch of headwaters of Río Tirica, alt. 2120 m, Central Section of Chimantá Massif, Bolívar, Venezuela, 11 Feb 1955, *Julian A. Steyermark & John J. Wurdack 730* (holotype VEN). Paratypes. Bolívar: Chimantá Massif, Torono-tepuí, below upper falls of Caño Mojado, alt. 1895–1910 m, 20 Feb 1955, *Steyermark & Wurdack 955;* Chimantá Massif, summit of Abácapa-tepuí, alt. 2125–2300 m, 13 April 1953, *Steyermark 74879;* Apacara-tepuí on slope to summit, 2000–2150 m, 20 June 1953, *Steyermark 75828.*

20b. **Ilex sulcata** var. **pygmaea** var nov.

Differt a typica laminis plerumque 2.8–3.5 cm longis × 0.9–1.7 cm latis.

Type. Swampy savanna in depression along tributary valley of E branch of headwaters of Río Tirica, alt. 2120 m, Central Section of Chimantá Massif, Bolívar, Venezuela, 13 Feb 1955, *Julian A. Steyermark & John J. Wurdack 847* (holotype NY; isotype VEN).

21. **Ilex magnifructa** Edwin, sp. nov.

Arbor glabra 6 m alta, ramis ramulis et virgis in sicco atrobrunneis; laminis coriaceis, marginibus integris, revolutis, apice obtuse-orbicularibus, non nunquam brevissimis retusis, basibus obtusis vel orbicularibus vel acutis, latissimis decurrentibus brevissimis petiolis, in sicco supra atrolucidis viridis venulis remotis subobsoletis, subtus pallidioribus, obscurioribus brunneis, 5–7 jugis venarum alternariis parvis magnis prominenter, punctatis roseis, laminis maturis usque ad ca. 9.0 cm longis plerumque 7.1–8.3 cm longis × 3.7–4.5 cm latis (raro laminis brevibus sed latioribus praeditis ca. 4.0–5.0 cm longis), plerumque late-ovatis vel late-ellipticis vel elliptice-ovatis, raro subovatis; petiolis brevissimis ca. 2.0–4.0 mm longis, incrassatissimis; ♀-floribus (ex fructo) solitariis, axillaribus et lateralibus, pedicellis longissimis 2.6–3.2 cm longis, striatulis, calycis lobis 4, magnis, ca. 2.5 mm longis late-ovatis, apice acutis; baccis drupis in sicco nigris (in vivo roseis?) magnis ca. 8.0–8.5 mm longis × 5.5 mm diametro subglobosis, exocarpis rugulosis, duris, stigmatis lobis 4, ex parte confluentibus, subcoronatis, mesocarpis farinosis, largis, roseis (in vivo glutinosis); pyrenis 4 dorsaliter et lateraliter profunde unicanaliculatis; stirpe ♂- et ♀-ignoti.

Type. Occasional, stream side, small savanna and along left fork of Cano Yutaje, alt. 1250 m, Cerro Yutaje, Serrania Yutaje, Río Manapiare, Amazonas, Venezuela, 12 Feb 1953, *Bassett Maguire & Celia K. Maguire 35192* (holotype US).

22. **Ilex spruceana** Reiss., Fl. Bras. **11**(1): 59. *t. 13, fig. 12,* 1861.

Ilex spruceana var. a. *genuina* Loes., Nova Acta Acad. C. L. C. G. Nat. Cur. **78**: 399. 1901.
I. spruceana var. b. *guainiensis* Loes., Nova Acta Acad. C. L. C. G. Nat. Cur. **78**: 399. 1901.

Distribution. River banks and wet woods. VENEZUELA. Ríos Yatua-Pacimoni, Casiquiare, Vasiva and Guainia at alt. 175 m.

23. **Ilex duidae** Gleason, Bull. Torrey Club **58**: 384. 1931.

Distribution. Savanna hills and ridge crest at summit. VENEZUELA. Cerro Duida at alt. 1025–1200 m.

24. **Ilex oliveriana** Loes., Nova Acta Acad. C. L. C. G. Nat. Cur. **78**: 406. *t. 13, fig. 1,* 1901.

Ilex macoucoua forma? Oliver, Im Thurn, Roraima Expedition, in Trans. Linn. Soc. Ser. Bot. II **2**: 273. 1887.

Distribution. Montane woodlands and slope forests near streams and along stream banks. BRITISH GUIANA. Near Roraima. VENEZUELA. Ilu-tepuí, Gran Sabana; Chimantá Massif, central section Abácapa-tepuí, Torono-tepuí, Río Tirica at alt. 850–1700 m.

The remaining species pertain to sections of the genus other than *Guayanoïlex.*

25. **Ilex bolivarensis** Edwin, sp. nov.

Frutex magna ad 3 m alta, in sicco ramis griseis glabris (aliquando pauci capillis longioribus permixtis), ramulis griseis puberulis sparsis capillis parvis albis, virgis brunnescentiis permixtis puberulis parvis albis et longioribus ca.

1.0 mm capillis nigris; laminis glabris, coriaceis, marginibus integris, apicibus subrotundatis, raro retusis vel parvis acuminatis, basibus acutis vel subspathulatis vel non nunquam spathulatis, in sicco supra atrolucidis viridis, brunnescentibus viridis vel pallidis brunneis, venulis planis, subobsoletis, subtus obscuris pallidioribus, profunde punctatis, punctatibus roseis ad nigris, venulis obsoletis vel subobsoletis visibilibus vix elevatis, 2.6–3.4(–3.8) cm longis × (1.1–)1.3–1.7(–1.9) cm latis, obovatis ad subspathulatis aliquando spathulate-obovatis, non vel ex parte decurrente in aliquantis crassatis, 3.0–4.6 mm (raro ad 5.9 mm) longis, puberulis petiolis; parvis petiolatis, petiolis ca. 1/8–1/11 laminarum aequantibus; ♂-inflorescentiis fasciculatis, axillaribus (raro solitariis) fere in lignis horotinis vel dispositis-fasciculatis, pedicellatis, basibus lignis horotinis, 4- vel 5-meris, 2–5 pedunculis in fasciculis, plerumque 1 × divisis, 3–5(–7) floribus; ex fructu ♀-floribus axillaribus solitariis, 4-meris, pedicellatis, omnino in lignis horotinis, pedicellis puberulis, ca. 1.0–1.2 cm longis, calycis-tubis brevibus, glabris, apice lobis rotundatis latis, brevibus ca. 0.7 mm longis, sparsis ciliolatis; stirpe ♂ calycis-tubis brevibus, puberulis vel aliquando glabris, lobis ca. 1.1–1.4 mm longis ovatis, apice acutis vel obtusis, sparsis ciliolatis, raro glabris, petalis ca. 3.3–3.6 mm longis, elliptice-ovatis ad latis ovatis, staminibus 0.7 mm longis, filamentis 0.3 mm longis, pistillodiis ovoideis; baccis drupis in vivo nigropurpureis, in sicco ovoideis subglobosis, sublaevis, brunneis, 7.0 mm longis × 5.0 mm diametro, stigmatis coronatis, mesocarpis farinosis, mediis ad largis; pyrenis 4, laevibus, trigonis, roseis ad brunnescenti-roseis, dorsaliter 4.3 mm longis × 1.2 mm latis; stirpe ♀-ignoti.

Type. Fruit black-purple, rare, petioles purple, alt. 2150 m, Chimantá Massif, Torono-tepuí, Bolívar, Venezuela, 21 Feb 1955, *Julian A. Steyermark & John J. Wurdack 1009* (holotype NY; isotype VEN). Paratypes. Bolívar: male, flowers 5-merous, white, pink-tinged, 20 Feb 1955, *Steyermark & Wurdack 957;* male, flowers 4-merous, 20 Feb 1955, *Steyermark & Wurdack 956.* Colombia: Amazonas, male, flowers greenish-white, 6 Sept 1959, *Maguire, Maguire & Fernandez.*

26. **Ilex steyermarkii** Edwin, sp. nov.

Arbor 4.5–6.0 m alta, ramis, ramulis et virgis in sicco atrissimis griseis nigris, puberulis vel dense puberulis capillis brevibus albis rigidis, brunneis vel plerumque nigris; laminis plerumque chartaceis ad subcoriaceis, non nunquam ciliolatis capillis brevibus nigris in marginibus integris revolutis vel glabris, apice plerumque acutis, non nunquam breviacuminatis vel retusis, raro rotundatis, obtusis, basibus acutis vel cuneatis, non vel tenuissime decurrentibus, in vivo supra profunde viridis venulis pallidioribus aequis, subtus pallidis viridis, in sicco supra lucide brunneo-viridis vel brunneis 6 jugis venarum aliquantum prominenter impressis, subtus obscurobrunneis venulis concoloratis, non nunquam sub-prominenter elevatis, 6 jugis venarum parum singulorum ramulis alternatis, punctatis, (3.1–)4.0–5.5(–6.5) cm longis × (1.0–)1.4–2.3(–2.7) cm latis, plerumque obovatis, non nunquam ellipticis, aliquando ovatis; petiolis non vel paucis incrassatis, glabris, vel sparsissimis puberulis, in laminis maturis 5.2–11.0 mm plerumque 6.5–9.5 mm longis; ♀-floribus (ex fructo) 4-meris solitariis, axillaribus vel lateralibus, raro racemosis, brevibus pedicellatis, pedicellis sparsis puberulis vel glabris, plerumque 2.0–5.0 mm longis; baccis drupis in sicco pallide-brunneis, sublaevis, globosis, 6.0 mm longis × 5.0 mm diametro, stigmatis-lobis integris confluentibus, parvis, coronatis; calycis lobis 4, glabris, deltoideis acutis brevibus, minus quam 1.0 mm longis, mesocarpis tenuis, in sicco farinosis; pyrenis 4, roseis ad brunneis, dorsaliter laevis, trigonis, lateraliter rotundatis ad ventraliter obtusis apice apendicula parva; stirpe ♂- et ♀-ignoti.

Type. Along base of SE facing sandstone bluffs of Chimantá-tepuí (Toronotepuí), alt. 1700 m, Chimantá Massif, Bolívar, Venezuela, 21 May 1953, *Julian A. Steyermark 75501* (holotype NY; isotype VEN).

27. **Ilex solida** Edwin, sp. nov.

Arbor ad 3 m alta, ramis in sicco atrogriseis, glabratis, ramulis et virgis in sicco nigris vel brunnescenti-nigris sparsis ad subdense puberulis capillis brevissimis (usque ad ca. 0.1 mm longis) albis; laminis coriaceis ad incrassate-coriaceis, apice orbicularibus obtusis brevissimis retusisque vel non, aliquando subacutis, basibus subacutis ad suborbicularibus vel obtusis omnino vel ex parte incrassate decurrentibus, in vivo supra atroviridis subtus pallidis viridis, in sicco utrinque brunnescenti-viridis ad brunneis, venulis subobsoletis ad obsoletis, subtus punctatis, (5.3–)6.4–8.5(–9.7) cm longis × 3.3–4.7 cm latis, plerumque ovatis, aliquando late-ovatis vel ellipticis raro obovatis; petiolis brevibus ca. 2.0–4.0 mm longis, glabris incrassatissimis; ♀-floribus (ex fructu) solitariis axillaribus vel lateralibus, pedicellis glabris ca. 1.8 cm longis, 4-meris, calycis lobis 4, ovatis apice acuta, sparsis puberulis, eciliolatis; baccis drupis in sicco nigris rugosis subellipsoidiis globosis, ca. 7.0 mm longis × 4.5 mm diametro, stigmatis lobis 4, ex parte confluentibus, mesocarpis largis farinosis (in vivo glutinosis roseis); pyrenis 4 trigonis, dorsaliter laevibus 1–3 striatulatis, ca. 4.3 mm longis × 3.0 mm latis, mollis; ♂- et ♀-floribus ignoti.

Type. Southeast facing forested slope beneath escarpment, alt. 1880–1955 m, Chimantá Massif, Agparaman-tepuí, Bolívar, Venezuela, 26 Feb 1955, *Julian A. Steyermark & John J. Wurdack 1168* (holotype US; isotype VEN).

28. **Ilex parvifructa** Edwin, sp. nov.

Frutex vel arbor parva, ramis in sicco griseis nigris, ramulis et virgis atrobrunneis, pedunculis et pedicellis interdum puberulis capillis brevissimis vel subglabris (capillis saepe versibus); laminis chartaceis ad tenue-coriaceis, marginibus integris, paulorevolutis, apice acutis rarissimo subobtusis vel breviacuminatis, basibus cuneatis ad acutis, in sicco supra lucide viridis brunneis, subtus plerumque obscuris brunneis, epunctatis, 4.6–5.8(–6.4) cm longis × (1.7–)2.2–2.6(–3.1) cm latis, plerumque obovatis, non nunquam ovatis; petiolis plerumque 7.6–9.1 mm longis, pauci longioribus, parvis vel non incrassatis; ♀-floribus (ex fructu) solitariis, pedunculatis, pedunculis plerumque 1 × divisis pedicellis triplis, pedunculis ca. 5.0–8.5 mm longis, puberulis, pedicellis 3.0–5.2 mm longis, puberulis; baccis drupis immaturis globosis, ca. 4.0 mm longis × 4.0 mm diametro, in sicco pallideo-brunneis viridis sublaevis, stigmatis magnis, discoide-capitatis, ex parte confluentibus 4-lobis, calycis 4-meris glabris lobis sparsis ciliolatis, acutis, mesocarpis mediis, subglutinosis; pyrenis 4, immaturis sed manifeste dorsaliter 3(–5) striatulatis; stirpe ♂- et ♀-ignoti.

Type. Shrub or small tree, infrequent in woodland along watercourse, North Valley, alt. 1600–1700 m, Cerro Guaiquinima, Río Paragua, Bolívar, Venezuela, 10–12 Jan 1952, *Bassett Maguire 33091* (holotype US).

29. **Ilex neblinensis** Edwin, sp. nov.

Frutex vel arbor parva ad 8 m alta, lignis plerumque glabris vel subglabris raro puberulis vel pubescentibus capillis nigris, in sicco atrobrunneis vel non nunquam brunneis vel nigris; laminis subcoriaceis vel coriaceis plerumque (cum lignis) glabris vel (cum lignis) pubescentibus capillis nigris, marginibus integris revolutis puberulis ciliolatis apicibus obtuse-rotundatis retusisque raro subacutis retusisque rarissimo subacutis ad acutis brevissimis acuminibus praeditis, basibus acutis vel cuneatis aliquando subobtusis vel subspathulatis tenue vix vel non decurrentibus petiolis vix vel non incrassatis, in vivo supra viridis, subtus pallidis viridis punctatis, punctis frequenter impressis in sicco viridis brunnescenti-viridis vel brunneis 2.4–8.5 cm longis (plerumque typica 2.5–4.0 cm longis) rarissimo plus quam 6.0 cm longis × 2.1–2.8(–4.5) cm latis, late-ovatis vel latissime-ovatis vel late-obovatis; petiolis plerumque glabris vel subglabris raro puberulis, plerumque 6.0–9.0(–10.1) mm longis; ♀-floribus ex fructu solitariis, axillaribus et lateralibus gemmis florigris productis vel racemose ambo axillaribus et lateralibus gemmis mixtis productis infra florigris et apice foliatis plerumque 5-(raro 4-) meris, calycis et pedicellis plerumque glabris aliquando (cum lignis) puberulis, pedicellis plerumque 10.0–13.0(–17.0) mm longis; baccis drupis maturis ovoideis ad subglobosis distincte subabrupte apice angustioribus laevis vel longitudine striatis 9.0–10.0 mm longis × 7.0–8.5 mm diametro in vivo et in sicco brunneis, mesocarpis tenue ad mediis, in sicco farinosis, stigmatis capitatis; pyrenis anguste-trigonis ad sublanceoloideis trigonis dorsaliter 3–5-striatulatis ad sublaevis; stirpe ♂- et ♀-ignoti.

29a. **Ilex neblinensis** var. **neblinensis.**

Laminis usque ad 6.5 cm longis plerumque 2.5–4.0(–5.0) cm longis × 2.1–2.8 cm latis.

Type. Shrub 1–3 m, fruit brown, locally frequent along E escarpment of upper Canon Grande basin, alt. 2100 m, Cerro de la Neblina, Río Yatua, Amazonas, Venezuela, 14 Dec 1957, *Bassett Maguire, John J. Wurdack & Celia K. Maguire 42400* (holotype US). Paratypes. Shrub or rounded tree in Cumbre Camp Swale, alt. 1800–1900 m, 16 Nov 1957, *Maguire, Wurdack & Maguire 42122, 42128* (tree to 8 m). Fruit brown, locally occasional along W escarpment, alt. 1800 m, 10 Jan 1954, *Maguire, Wurdack & Bunting 37193;* occasionally in scrub forest between Cumbre Camp and W escarpment, alt. 1700–1750 m, 13 Jan 1954, *Maguire, Wurdack & Bunting 37252.*

29b. **Ilex neblinensis** var. **wurdackii** Edwin, var. nov.

Differt a typica laminis longioribus et latioribus plerumque 6.7–8.5 cm longis × 3.5–4.5 cm latis.

Type. Summit, along W escarpment, shrub 0.8 m, alt. 1700–1800 m, Cerro de la Neblina, Río Yatua, Amazonas, Venezuela, 6 Jan 1954, *Bassett Maguire, John J. Wurdack & George S. Bunting 37081* (holotype NY).

30. **Ilex soderstromii** Edwin, sp. nov.

Arbor ad 4 m alta, ramis griseis glabris, ramulis et virgis plerumque puberulis in sicco roseis brunneis ad nigris; laminis coriaceis plerumque glabris aliquando marginibus capillis brevibus albis integris incrassatis revolutis vel plane praeditis, apice acutis non nunquam breviacuminatis raro obtusis vel retusis, basis cuneatis non nunquam acutis ex parte ad omnino decurrentibus petiolis, supra lucide-viridis costis impressis, 7–10 jugis venularum subobsoletis subtus pallidioribus obscurioribus sufflavis ad brunnescenti-viridis, punctatis, costis elevatis venulosis parvissimis prominenter, plerumque 2 × longioribus quam latioribus (5.0–)7.5(–9.0) cm longis × (2.7–)3.6(–4.5) cm latis, lanceolatis vel anguste-obovatis ad ovatis raro late-ovatis; petiolis ca. 6.0–12.0 mm longis glabris non ad incrassatissimis, ca. 1/5–1/9 × laminis aequilongis (plerumque 1/7); inflorescentiis pluri-fasciculatis axillaribus lignis horotinis, ♂-floribus pedunculatis, pedunculis sparsis puberulis 2.0–11.0 mm longis 1 × divisis pedicellis triplis vel quintis vel septis puberulis 1/2–1/3 pedunculis aequaliter, 4–5-meris, calycis lobis ovatis apice acutis vel obtusis, plerumque dense ciliolatis, petalis saepe fugitivis 2–3 × calycis superantibus oblongis plerumque obtusis, staminibus petalis aequantibus filamentis glabris ca. 3–4 × superantibus 1.0 mm longis antheris, pistillodiis conicis sublaevis brevibus ca. 0.5 mm longis, stylis sublaevis ca. 0.5 mm longis, stigmatis punctis vel omissis, stirpe ♀ omnino pedicellatis, pedicellis plerumque non superantibus 2.0 mm longis plerumque brevioribus floribus subsessilis simulantis, calycis paulo ciliolatis quam ♂, staminodiis brevioribus petalis, ovariis ovoideis, stylis omissis, stigmatis magnis capitatis lobis confluentibus, ex fructo calycis plus minusve solutis baccis drupis; baccis drupis rugulosis in sicco brunneis ovoideis ca. 5.0 mm longis × 4.0 mm diametro, stigmatis capitatis nigris, mesocarpis largis, farinosis; pyrenis 4 late-trigonis dorsaliter 3-striatis 2-sulcatis.

30a. **Ilex soderstromii** var. **soderstromii.**

Laminis (5.0–)5.4–7.5(–8.0) cm longis × (2.7–)2.9–3.6 cm latis, obovatis.

Type. Occasional, tree 2–25 m tall, young fruits pale green, savanna and low savanna-forest near Kaieteur Falls, alt. ca. 430 m, Kaieteur Plateau, British Guiana, 11 March 1962, *Richard S. Cowan & Thomas R. Soderstrom 2069* (holotype US). Paratypes. Forest along Mure-Mure Creek to ca. 3 miles above mouth, alt. ca. 430 m. Frequent tree in marsh forest margin, ca. 4 m tall. Flowers white, 15–16 March 1962, *Cowan & Soderstrom ♂ 2191;* forest along trail from Plane-landing to Kaieteur Falls, ca. 430 m alt., 11 Feb 1962, *Cowan & Soderstrom ♂ 1817,* and ♀ *1825,* in both, flowers white.

30b. **Ilex soderstromii** var. **ovata** Edwin, var. nov.

Differt a typica laminis longioribus et latioribus plerumque 9.0–9.5 cm longis × 5.3–6.1 cm latis, ca. 1.5 × longiore quam latiore late-ovatis.

Type. Tree ca. 7 m tall, flowers white; forest along trail from Plane-landing to Kaieteur Falls, alt. 430 m, Kaieteur Plateau, British Guiana, 11 Feb 1962, *Richard S. Cowan & Thomas R. Soderstrom 1824* ♂ (holotype US).

31. **Ilex savannarum** Wurdack, Mem. N. Y. Bot. Gard. **10**(4): 3. *fig. 23 A–E,* 1961.

Key to Varieties of *Ilex savannarum*

1. Leaf-blades with margins closely crenate-serrate or -serrulate, coriaceous; male flowers all fasciculate. 31a. var. *savannarum.*
1. Leaf-blades with margins entire, subcoriaceous; male flowers sometimes solitary. 31b. var. *morichei.*

31a. **Ilex savannarum** Wurdack var. **savannarum.**

Distribution. In savannas on stream banks and in Bromeliad zone. VENEZUELA. Río Guiania, Savana el Venado, Santa Cruz margem del Río Atabapo at alt. 140 m.

31b. Ilex savannarum Wurdack var. **morichei** Edwin, var. nov.

Arbor 4.0 m alta, bacca drupa immaturi in vivo brunnea, in sicco nigra, pyramidaloidis; differt a typica laminis tenuioribus subcoriaceis, marginibus integris et stirpe ♂ aliquando solitaria.

Type. Occasionally in cumbre, alt. 1250 m, Cerro Moriche, Río Ventuari, Amazonas, Venezuela, 15 Jan 1951, *Bassett Maguire, Richard S. Cowan & John J. Wurdack 30935* ♀ (holotype US). Paratype. Cumbre, Cerro Moriche, alt. 1250 m, *Maguire, Cowan & Wurdack 30934* ♂.

32. Ilex macarenensis Cuatr., Trop. Woods **101**: 13. 1955.

Distribution. Summit of mountain and vicinity. COLOMBIA. Meta, Cordillera La Macarena, macizo Renjifo at alt. 1300–1900 m.

33. Ilex vacciniifolia Kl., in Schomb. R., Fauna et Flora Brit. Guiana. 1097. 1848. (nomen).; Reiss., Fl. Bras. **11**(1): 57. *t. 13, fig. 4,* 1861.

Distribution. VENEZUELA. Ptari-tepuí, Cerro Acopán, Caroni at alt. 1800–2000 m; Sucre, (Cerro Turumuquire) Cerro de Diablo and Cerro de Neveri; British Guiana.

34. Ilex inundata Poepp. ex Reiss. in Flor. Bras. **11**(1): 43. *t. 11, fig. 5,* 1861.

Ilex macoucoua Poepp. in Herb. nec Aubl.
Ilex riparia Reiss., Fl. Bras. **11**(1): 43. *t. 11, fig. 6,* 1861.

Distribution. COLOMBIA. Amazonas—Vaupes Rio Apaporis; Jinogojé and vicinity at alt. ca. 230 m. BRAZIL. Pará and Amazonas.

35. Ilex psammophila Reiss., Fl. Bras. **11**(1): 42. *t. 11, fig. 4,* 1861. (based on mss. Mart. fide Loes., Nova Acta Acad. C. L. C. G. Nat. Cur. **78**: 386. 1901).

Distribution. VENEZUELA. Río Cunucunuma, Río Orinoco, Sierra de Lema, Río Chicanán, Río Caroní, Río Uiri-yuk, at alt. 200–400 m. BRAZIL. Especially eastern provinces of Bahía, Espirito Santo etc.

Habitat. (In Guayana) In forests at edge of savannas and along river banks. (Brazil) From dry hillside slopes to river banks.

36. Ilex umbellata Kl., in Schomb. R., Fauna et Flora Brit. Guiana. p. 1183. 1848.

I. humirioides Reiss., Fl. Bras. **11**(1): 52. *t. 12, fig. 13.* (pro parte.), 1861.

Distribution. VENEZUELA. Raudal de Trapichito; Delta del Ventuari; Alto Orinoco at alt. 126 m. BRITISH GUIANA. "Ad Roraima."

37. Ilex guianensis (Aubl.) O. Ktze., Rev. Gen. **1**: 113. 1891.

Macoucona guianensis Aubl., Hist. Pl. Guian. **1**: 88. *t. 34.* 1775.
Labatia Scop., Introd. p. 197. 1777.
Ilex acuminata Willd., Sp. Pl. **1**: 711. 1797.
I. macoucoua of authors.

I. macoucou Kl. in Schomb. R., Fauna et Flora Brit. Guiana. p. 1183. 1848.
I. celastroides Kl. in Schomb. R., Fauna et Flora Brit. Guiana. 1848. (p.p.); et in Linnaea 22: 58. 1849.
I. bumelioides Griseb., Bonplandiana **6**: 7. 1858., non H. B. K.
I. cumanensis Turcz., Bull. Soc. Nat. Mosc. **31**(1): 456. 1858.
I. obcordata Triana, Prodr. Fl. Nov. Gran. in Ann. Sc. Nat. V **16**: 376. 1862.; non Sw.
I. occidentalis Hemsl., Biol. Cent. Am. Bot. **1**: 187. 1879. non Macf.
I. guianensis O. Kuntze, Rev. Gen. **1**: 113. 1891.
I. guianensis (Aubl.) O. Kuntze var. *A. macoucoua* (Pers.) Loes. in Urban Symb. Antill. **1**: 346. 1899.

Distribution. COLOMBIA. Amazonas; Río Miritiparaná, Cano Guacayá and Río Popeyacá at alt. 230 m. From Mexico to Venezuela west to Colombia; also Caribbean Islands.

38. Ilex theezans var. **riedelii** Loes., Nova Acta Acad. C. L. C. G. Nat. Cur. **78**: 377. 1901.

Ilex ebenacea Reiss., Fl. Bras. **11**(1): 44. 1861 (pro parte).
I. fertilis Warmg., Symb. Fl. Bras. **16**: 765. in Videnskab. Meddelels. Nat. Kjobenhavn. p. 367. 1879–80.
I. riedlaei Loes., Engl. Bot. Jahrb. **15**: 317. 1892.
I. theezans f. *riedelii* Loes. in Schwacke. Pl. Nov. Mineiras **2**: 6. 1900. (nomen.)

Distribution. VENEZUELA–BRAZIL border. Serra do Sol, Territorio Do Río Branco, Brazil and Estado Bolívar, Venezuela at alt. 2180 m. BRAZIL. Minas Gerais, Serra de Piedade. SANTO DOMINGO and PUERTO RICO.

39. Ilex gleasoniana Steyermark, Fieldiana Bot. **28**: 322. 1952.

Distribution. VENEZUELA. Mt. Duida at alt. 2000 m.

40. Ilex conocarpa Reiss., Fl. Bras. **11**(1): 65. *t. 13, fig. 14,* 1861.

Distribution. VENEZUELA. Caroní, Cerro Opacara at 900 m elevation. BRAZIL. Goyaz, Minas Gerais and Rio de Janiero.

41. Ilex myricoides H. B. K., Nov. Gen. et Sp. **7**: 71. 1825.

I. hippocrateoides Triana et Planch., Prodr. Fl. Nov. Gran. in Ann. Sc. Nat. V **16**: 376. 1862.; non H. B. K.
I. naiguatina Loes., Nova Acta Acad. C. L. C. G. Nat. Cur. **78**: *pl. 3, fig. 5,* 1901.

Distribution. COLOMBIA. Popayan. VENEZUELA. Merida.

42. Ilex kunthiana Triana, Prodr. Fl. Nov. Gran. in Ann. Sc. Nat. V **16**: 375. 1862.

I. paltoria H. B. K., Nova. Gen. et Sp. **7**: 54. 1825.
I. elliptica Willd. mss. (fide Loes., Nova Acta Acad. C. L. C. G. Nat. Cur. **78**: 182. 1901.); non H. B. K.

43. Ilex maguirei Wurdack, Mem. N. Y. Bot. Gard. **10**(4): 4. *fig. 23 F–H,* 1961.

Distribution. VENEZUELA. Cerro de la Neblina, Río Yatua at alt. 1500–1700 m. Summit of mountain, on south slope of cumbre.

44. Ilex karuaiana Steyermark, Fieldiana Bot. **28**: 323. 1952.

Distribution. VENEZUELA. Ptari-tepuí at alt. 1220 m; dense forest at base of Cerro along Río Karuai.

45. Ilex retusa Kl. in Schomb. R., Fauna et Flora Brit. Guiana. p. 1097. 1848.

I. retusa f. a. *genuina* Loes., Nova Acta Acad. C. L. C. G. Nat. Cur. **78**: 187. 1901.
I. retusa f. b. *brunnescens* Loes., Nova Acta Acad. C. L. C. G. Nat. Cur. **78**: 187. 1901.
I. stenophylla Steyerm., Fieldiana Bot. **28**: 325. 1952.
I. retusa f. *glabra* Steyerm., Fieldiana Bot. **28**: 959. 1957.
I. retusa f. *glaucescens* Steyerm., Fieldiana Bot. **28**: 959. 1957.
I. retusa f. *major* Steyerm., Fieldiana Bot. **28**: 960. 1957. (root-shoot fide Wurdack, personal conversation).
(*I. retusa* var. *subepunctata* Loes., nomen. G. H. H. Tate 557, Mt. Duida).

Distribution. Open savannas, bush forests; *Bonnetia* forests, thickets, montane rain forest, open summits and escarpments and slopes. VENEZUELA. Chimantá Massif, Auyantepuí; Kavanayen, Uei-tepuí, Cerro Guaiquinima, Sierra Ichun, Río Uarama below Uarama-tepuí, Cerro Uaipan, Cerro Orepuchi Río Caroni, Alto Río Cuyuni, Cerro Uroi, Cerro de la Neblina, Río Yatua, Cerro Yutaje, Río Manapiare, Cerro Duida. COLOMBIA. Vaupés: Cerro Isibukuri, Río Kananari. BRITISH GUIANA. Near Roraima, at alt. 600–2300 m.

46. Ilex andarensis Loes., Nova Acta Acad. C. L. C. G. Nat. Cur. **78**: 206–207. *t. 12, fig. 2,* 1901.

Distribution. VENEZUELA. Bolívar; Ríos Icabaru y Hacha. PERU. Monte Andara at alt. 450–850(–?) m.

47. Ilex yutajensis Wurdack, Mem. N. Y. Bot. Gard. **10**(4): 3. *fig. 24 D–F,* 1961.

Distribution. VENEZUELA. Serranía Yutaje, Río Manapiare, Cerro Yutaje at alt. 1500 m.

48. Ilex casiquiarensis Loes., Nova Acta Acad. C. C. C. G. Nat. Cur. **78**: 437. 1901.

Ilex affinis Reiss., Fl. Bras. **11**(1): 70. 1861. (pro parte).

Distribution. VENEZUELA. Amazonas: Ríos Casiquiare, Guainia, Alto Orinoco, Pacimoni and tributaries at alt. 100–140 m. BRAZIL. Alto Amazonas: near San Carlo near Rio Negro above the mouth of Río Casiquiare.

49. Ilex martiniana D. Don., in Lamb. Pin. **2**: ed. 2; App. 5. 1824.

Ilex martiana Walp., Rep. **1**: 540. 1842.
I. lanceolata Kl. in Schomb. R., Fauna et Flora Brit. Guiana. p. 1183. 1848.
I. panniculata Turcz., Bull. Soc. Nat. Mosc. **31**(1): 456. 1858.

Distribution. BRITISH GUIANA. In fields and woods near river and low stream banks (occurring very close to Guayana and blending into *I. jenmanii* Loes.).

50. **Ilex laureola** Tr. & Pl., Prodr. Fl. Nov. Gran. in Ann. Sc. Nat. V **16**: 377. 1872.

Ilex laureola f. a. *genuina* Loes., Nova Acta Acad. C. L. C. G. Nat. Cur. **78**: 440. 1901.
Ilex laureola f. b. *neglecta* Loes., Nova Acta Acad. C. L. C. G. Nat. Cur. **78**: 440. 1901.

Distribution. VENEZUELA. Sierra Ichún, (Salto Ichún) del Río Ichún, tributary del Río Paragua; Chimantá Massif, Torono-tepuí Río Tirica to Río Torono; Río Guainia southeast of Maroa; Río Cunucunuma, Río Orinoco 1 km above Culebra Rapids at alt. 120–500 m. BRITISH GUIANA. Near Mount Roraima. COLOMBIA. In the Andes, provinces of Bogotá and Tolima at alt. 800–1600 m.

51. **Ilex ptariana** Steyermark, Fieldiana Bot. **28**: 324. *fig. 59, 60,* 1952.

Distribution. Densely forested, steep south facing slopes and on woodland edges of east slope. VENEZUELA. Ptari-tepuí between ''Cave Rock'' and base of high sandstone bluff and east of ''Cave Rock''; Serra Do Sol frontier between Territorio Do Río Branco, Brazil and Estado Bolívar, Venezuela at alt. 2130–2405 m.

52. **Ilex cowanii** Wurdack, Mem. N. Y. Bot. Gard. **10**(4): 6. *fig. 24 A–C,* 1961.

Distribution. VENEZUELA. Cerro Huachamacari, Río Cunucunuma.

53. **Ilex glaucophylla** Steyermark, Bol. Soc. Venez. Cienc. Nat. **15**: 176. 1954.

Distribution. In wet woods. VENEZUELA. Estado Miranda at alt. 1200 m. (Included due to close affinity with *I. ptariana, I. parvifructa* and other Guayana species.)

54. **Ilex tateana** Steyermark, Fieldiana Bot. **28**: 330. 1952.

Distribution. Sandstone bluffs. VENEZUELA. Cerro Duida near Caño Negro at alt. 1095–1520 m.

55. **Ilex apicidens** N. E. Brown, Trans. Linn. Soc. Ser. Bot. II **6**: *pl. 1, fig. 1–6,* 1901.

Rhamnus quitensis Willd. mss. ex Roehm. et Schult., Syst. **V**: 295. 1819.
R. quitensis Spreng., Syst. **1**: 769. 1820. (pro parte).
Ilex bumelioides H. B. K., Nov. Gen. et Sp. Am. **7**: 56. 1825.
I. quitensis var. *apicidens* Loes., Nova Acta Acad. C. L. C. G. Nat. Cur. **89**: 281. 1908.

Distribution. Reported from Guayana, but no specimens seen.

EUPHORBIACEAE [28]

Croton Linnaeus, Gen. Pl. 288. 1737; Sp. Pl. 1004. 1753.

This paper is the first of a series of reports planned for Euphorbiaceae obtained in the course of the Garden's explorations of Guayana. It is intended to give a systematic review of new species, plus a synopsis, relative to the area, of material published to date and arranged into a key.

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[28] By Eugene Jablonski.

Müller of Argau's monograph of *Croton* of the world, based on the most minute analysis of material available at that time (1866 and 1873), was a monumental job and commends admiration; nothing similar has been done since.

The number of species of *Croton* for the world given in DeCandolle's Prodromus was 453. Today the number of *Croton* of the world stands around 1000, three-fourths of which are from the New World, about 470 from South America, 280 from the rest. And South America with its 470 described species is still the least explored continent of the world.

Six of the species described herein are closely related to each other and belong to the *C. matourensis*-group, and seem to be as many geographically isolated endemics. The relations of the other three are less close.

With the exception of four species (*C. galeopsifolia, C. calycularis, C. stahelianus* and *C. arirambe*), all 25 post-Müllerian types were examined and are either in the herbarium of The New York Botanical Garden (NY), or have been obtained on loan through the courtesy of Arnold Arboretum (A), Chicago Field Museum (F), and Utrecht (U).

A more serious problem is faced in regard to the 28 pre-Müllerian and Müllerian types. Through fortunate circumstances, The New York Botanical Garden possesses 4 Spruce isotypes: *C. benthamianus, C. palanostigma, C. caryophyllus* and *C. mollis*, and 10 photographs of other types (*C. matourensis, C. spruceanus, C. hostmanni, C. subincanus, C. suavis, C. cajucara, C. guayanensis, C. martii, C. amazonicus, C. umbratilis*). The remaining 14 types are known to me only from description. In all instances of pre-Müllerian and Müllerian species, actually no holotypes have been designated and a great number of syntypes will have to be examined in European herbaria, with lectotypes and neotypes yet to be designated.

The present is an artificial key, but it also intends to express natural relationship so far as possible. It is thought that certain vegetative characters, such as indumentum, presence of glands at the base of blade, dissected shape and ciliate margin of stipules, bracts and calyx lobes, are more expressive of natural relationship than bisexuality of basal glomerules, or their discontinuity, or flatness versus reduplication of calyx lobes, as used by Müller under sect. *Eucroton*. Shape and ornamentation of seeds are undoubtedly important taxonomically but frequently unobtainable.

Because of the tentative character of the key, it appears impractical to attempt to use and redefine the old sectional nomenclature.

Key to the Species of *Croton*

1. Indumentum of appressed scales; shrubs and trees, never herbaceous.
    2. ♀ flowers with petals, leaf membranaceous, sparingly lepidote on both sides, nonglanduligerous at the base (sect. *Elutheria*). 1. *C. glabellus.*
    2. ♀ flowers without petals, sometimes with petals reduced to setaceous rudiments, leaf coriaceous (*C. matourensis*-group).
        3. Leaf-blade biglandulate at the base or on top of petiole.
            4. Spikes subumbellately arranged at the end of branches, more or less equal in length; upper part of spikes ♂, lower part mixed ♀ and ♂; seeds suborbicular, more than 6.5 mm long.
                5. Capsules mediocre in size, depressed lobate, less than 2 cm high.
                    6. Leaves narrow lanceolate, wedge-shaped at base.
                        7. Central capsular column not developed; seeds about 6.5 mm long. 2. *C. cuneatus.*
                        7. Central capsular column persistent; seeds about 10 mm long. 3. *C. kaieteuri.*

6. Leaves broad elliptic (fruit and seeds unknown); spikes mostly ♂, only at the very base ♀.

8. ♀ flowers with pedicels about 5 mm long; spikes mostly 3 in subumbellate clusters; leaf more than 10 cm wide, broadly wedge-shaped at the base. 4. *C. neblinae.*

8. ♀ flowers subsessile; more than 3 spikes in subumbellate clusters; leaf narrow, less than 8 cm wide, rounded at the base. 5. *C. subcoriaceus.*

5. Capsules large, more than 2 cm high, ovate ellipsoid; seeds at least 2 cm long. 6. *C. roraimensis.*

4. Spikes very unequal in length at the end of branchlets; central spike unisexual ♂, long, lateral spikes bisexual, short.

9. Leaves lepidote on both sides; spikes dichasially arranged; seeds flat, 8–9 mm long. 7. *C. monachinoensis.*

9. Leaves glabrous, shiny above.

10. Leaves glabrous, shiny above, lepidote below; spikes 5–7 pleiochasially arranged; flowers not clearly segregated in the spikes; rudimental petals often present in the ♀ flowers; seeds small, 4.5 × 3 mm, subcylindrical.

11. Styles connate into a short column at the base. 8. *C. matourensis.*

11. Styles free at the base. 9. *C. lanjouwensis.*

10. Leaves glabrous on both sides; ♂ and ♀ flowers clearly segregated on the spikes; ♀ flowers with well developed linear-setaceous petals; seeds unknown. 10. *C. icabarui.*

3. Leaves not biglandular at the base or on top of the petiole. Blade coriaceous, glabrous above; lateral nerves conspicuously straight; ♀ flowers without petals; seeds unknown. 11. *C. pakaraimae.*

1. Indumentum mostly of stellate hairs, or rarely of simple hairs (by reduction of lateral branches); when stellate hairs have a lepidote center it is not appressed.

12. Trees, shrubs or herbaceous perennials.

13. Leaves with 2, rarely 4 basal or petiolar glands.

14. Inflorescence a long loose spike, over 10 cm long.

15. Leaves suborbicular or broad ovate, wider than one-half the length (*C. gossipifolia*-group).

16. Leaves coriaceous.

17. Blade lobate, palmatinerved.

18. Glands at base of blade adpressed into side of petiole. 12. *C. nuntians.*

18. Glands at base of blade stipitate. 13. *C. tonantinensis.*

17. Blade entire.

19. Blade cordate or rounded, and palmatinerved at base.

20. Leaf to 30 cm long, cordate at base, hairs distinctly stellate. 14. *C. palanostigma.*

20. Leaf not over 10 cm long, rounded at base, hairs indistinctly stellate, often reduced to a tubercle. 15. *C. caryophyllus.*

19. Blade sinuous-cordate and penninerved at base. 16. *C. pullei.*

16. Leaves membranaceous; ♂ petals spathulate.

21. Leaves distinctly 3 to 5-nerved at base; petioles longer than one-third of leaf; ovary glabrous. 17. *C. longiradiatus.*

21. Leaves penninerved or indistinctly trinerved at base; petioles shorter than one-fourth of leaf; ovary tomentose. 18. *C. spruceanus.*

15. Leaves elliptic, narrower than one-half of length, mostly more than 15 cm long; blade coriaceous, shiny, glabrous above, except along main vein (*C. polypleurus*-group).

22. Young leaves and shoots grayish, densely hairy, but not woolly below.

23. Capsules 14–18 mm high; seeds 10–11 mm long. 19. *C. yavitensis.*

23. Capsules 8 mm high; seeds 6 mm long. 20. *C. polypleurus.*

22. Young leaves and shoots rusty, woolly below (flowers and fruits unknown). 21. *C. kavanayensis.*

14. Inflorescence short dense spike, less than 10 cm long.

24. Basal leaf glands or petiolar glands patelliform sessile (*C. hostmanni*-group).

25. ♀ flowers numerous at base of spikes; distribution of flowers on spike not interrupted by a nude interval on rhachis.

26. Leaves moderately stellate, pubescent below. 22. *C. hostmanni.*
26. Leaves densely stellate, pubescent to silvery below . 23. *C. subincanus.*
25. ♀ flowers solitary at base of spike; leaves ovate, tip of leaf obtuse, mucronate, often tridentate; the distribution of flowers on spike is interrupted and rhachis is nude for an interval of 1.0–1.5 cm between ♂ and ♀ flowers. 24. *C. spiraeifolius.*
24. Basal glands on leaf-blade or top of petioles stipitate, inflorescence short (less than 10 cm long) ; (*C. suavis*-group).
27. Leaves wide (2.5–3.0 cm), ovate, grossly dentate on margin, triple-nerved at base; spikes with thin delicate rhachis interrupted between the ♂ and ♀ flowers.
28. Leaves 2.5 cm wide; capsules stellate tomentose; seeds ovoid, dark brown or black. 25. *C. subserratus.*
28. Leaves 1.0–1.5 cm wide; capsules glabrous; seeds flattened, light brown, minutely foveolate. 26. *C. sipaliwiensis.*
27. Leaves narrow (1 cm at the most), entire margin, penninerved.
29. Basal glands 4. 27. *C. suavis.*
29. Basal glands 2. 28. *C. mollis.*
13. Leaves without two basal or petiolar glands.
30. Sepals entire (*C. nervosus*-group).
31. Leaves and bracts not glandulose-ciliate.
32. Leaves silvery-gray and densely stellate lepidote below.
33. Leaves cuneate or rounded at base, not auriculate.
34. The stellate-lepidote hairs less than 0.2 mm in diameter; side nerves prominent on upper surface. 29. *C. nervosus.*
34. The stellate-lepidote hairs more than 0.4 mm in diameter; side nerves not prominent on upper surface. 30. *C. sacaquinha.*
33. Leaves subcuneate at base, and carrying two sometimes very minute auricles. 31. *C. potaroensis.*
32. Leaves not silvery-gray below.
35. Leaves woolly below.
36. Stipules leaflike, persistent. 32. *C. bolivarensis.*
36. Stipules setaceous, deciduous. 33. *C. stahelianus.*
35. Leaves sparingly covered with stellate-lepidote hairs below. 34. *C. cajucara.*
31. Leaves and bracts glandulate-ciliate. 35. *C. arirambe.*
30. Sepals dissected and glandulose-ciliate; leaves almost glabrous below (*C. essequiboensis*-group).
37. Leaves narrow ovate-lanceolate, 6 cm long at the most, rounded at base, almost glabrous below; setaceous appendages between calyx lobes of ♀ flowers wanting. 36. *C. essequiboensis.*
37. Leaves broadly ovate, up to 20 cm long, cuneate or subcuneate at base; setaceous down-curved appendages between sepals of ♀ flowers. 37. *C. tafelbergicus.*
12. Annuals.
38. Leaves not lobed, serrate margin; petioles shorter than 1/2 of leaf-blade; ♀ calyx lobes unequal in size and shape; staminate receptacle covered with hairs (sect. *Decarinium*).
39. Stem hirsute, basal glands of leaf long stipitate (to 2 mm). 38. *C. hirtus.*
39. Stem glabrous, basal glands of leaves short-stipitate or almost sessile. 39. *C. miquelensis.*
38. Leaves 3–5-lobed; petioles long, longer than 1/2 of leaf-blade; ♀ calyx lobes equal in size and shape; receptacle of ♂ flower glabrous (sect. *Astraea*). 40. *C. lobatus.*

1. Croton glabellus Linneaus, Sp. Pl. ed. 2. 1425. 1763.

Type. "Habitat in Jamaica" (Linn.) (not located).

Distribution. This 5–8 m tree of the rain forest is known from Jamaica, Mexico, Central America, the Andes of Venezuela, Colombia and Peru, Bolívar, Venezuela, and the Guianas. SURINAME. Maboen Creek, 31 Mar 1920, *B. W. 4640* (fl. NY). BRITISH GUIANA. Wabuwak, Kanuku Mts., alt. 200 ft, Oct

1948, *Wilson-Browne 414, F. D. 5813* (fl. fr. NY). VENEZUELA. Bolívar: tall forest south of El Dorado, alt. 215 m, 23 Jul 1960, *Steyermark 86586* (fl. NY).

C. glabellus is the sole representative of sect. *Elutheria* within the area. So far it has not been recorded from Brazil, but one specimen, *Krukoff 4832* (♂ fl. NY), Embira, lat. 7° 30′ S, long. 70° 15′ W, Amazonas, Brazil, seems to belong to this species, although the scales on both sides of the leaf-blade are sparingly developed. With no ♀ flower and fruit available, the identification remains doubtful.

2. **Croton cuneatus** Klotzsch, London Jour. Bot. **2**: 49. 1843.

C. surinamensis Müll. Arg. Linnaea **34**: 82. 1865.

Type. Klotzsch species was based on three syntypes, of which two come from Ega on the Amazon (as explained by Müll. Arg.), and one from British Guiana, *Schomburgk s.n.*, two widely separated regions. More recent collections have not bridged that gap.

Distribution. Tall shrub or spreading riverine tree to 15 m high; the Guianas, Bolívar, Venezuela, upper Amazon Region of northern Brazil and Iquitos, Peru. BRITISH GUIANA. Upper Mazaruni River, 13 Nov 1922, *Leng 109* (fl. NY); dense forest, Kuyuwini River, Essequibo tributary, 21–26 Nov 1937, *A. C. Smith 3025* (fl. NY); Makreba Falls, Kurupung River, 23 Feb 1959, *Pinkus 255* (fl. NY); Tumereng, Mazaruni River, 5 Mar 1943, *Fanshawe 2881, F. D. 6028* (fl. NY). SURINAME. Banks, Marowijne River between Pakire Creek and Herminadorp, 24 Mar 1949, *Lanjouw and Lindeman 3468* (♂ fl. fr. NY); banks of Toekoemoetoe Creek, Saramacca River Headwaters, 5 Jul 1944, *Maguire 24069* (fr.); 1 Feb 1951, *Florschutz 1113* (fl. NY). VENEZUELA. Bolívar: Río Paragua: edge of forest along river, between Guaiquinima and Rio Torono, alt. 280 m, 16 Apr 1943, *Killip 37518* (fl. fr. NY); Raudal`Aguacanta, 21 Jul 1943, *Cardona 706* (fl. NY); Raudal Guaiquinima, alt. 475 m, 15 Jan 1962, *Steyermark 90810* (fl. NY). Rio Cuyuni: alt. 150 m, Feb 1949, *Cardona 2779* (fl. NY); vic. El Dorado, alt. 80 m, 13 Apr 1957, *Bernardi 6483* (y. fr. NY); wooded slopes bordering savanna de los Chacharos, Rio Asa, alt. 290 m, 2 Aug 1960, *Steyermark 86793* (fr. NY). BRAZIL. Amazonas: Rio Negro: San Gabriel de Cachoeira, Jan–Aug 1852, *R. Spruce 2238* (fl. NY); Yucabi, Apr 1929, *Tate 971, 991* (fl. fr. NY); varzea land, Manariao, Rio Jurua, 27 May 1933, *Krukoff 4591* (fl. NY); restinga, São Paulo de Olivença, 26 Oct–11 Dec 1936, *Krukoff 8972* (fr. NY); Tocantins, 24 Feb 1944, *Ducke 1564* (fl. NY).

Croizat considers *C. cuneatus* a typical ''amazonian'' element with discernible affinity toward *C. oblongifolius* Roxb. of India and the Far East. On what this affinity is based is not made clear. Lanjouw has examined *Kappler 1505* and *Hostmann 1094* in Kew and has come to the conclusion that they cannot be distinguished from *C. cuneatus*. Because the name *C. cuneatus* was first given to a specimen in the Herb. Munich, although unpublished, Lanjouw considers that to be the type. Müll. Arg. laid great importance to the mixed sexuality of spikes at the base, and based the subsection *Cyclostigma* on this character. Some upper Amazonian specimens show mixed ♂ and ♀ flowers at the base of the spike (*Tate 971, 991; Ducke 1564; Krukoff 4591*), whereas others show a distinct separation into an upper purely ♂ and a lower purely ♀ segment (*Spruce 2238, Krukoff 8972*).

3. Croton kaieteuri Jablonski, sp. nov.

Arbor 14 metralis, 20 cm crassitudine. Stipulae lineares rigidulae 1-1/2–2 mm longitudine, facile deciduae, juveniles tantum visae. Petioli 2–4 cm longitudine. Lamina lanceolata 17–25 cm longitudine, 4-1/2–7 cm latitudine, basi cuneata, bi- vel quadri-glandulosa, apice modice acuta, margine integerrima, nonnunquam glandulas minutiusculas, 4–8 mm distantias gerentia, subtus dense, supra sparse lepidibus orbicularibus ca. 0.4 mm diametientibus tecta, penninervia, costis lateralibus 16–18 jugis. Lepides saepe in centro pilo longiusculo centrali erecto auctae. Inflorescentiae terminales 1–3 spiciformes, 14–28 cm longitudine, rhachidibus profunde sulcatis, 6–17 capsulas gerentes. Discus hypogyneus 5 lobatus, glandulis quadrangularibus, 2 mm longis, 1 mm latis. Bracteis squamiformibus, 1 mm longis, facile deciduis. Pedicellis paene nullis vel brevissimis. Calycis laciniis fructigeris externe lepidotis, interne glabris vel pilis stellatis vestitis, triangularibus, 3-1/2 mm longis, 2–2-1/2 mm latis. Calice aperto 10–11 mm diametienti. Columella capsulari 7–8 mm alta, persistenti, apice haud dilatata. Seminibus arillatis orbicularo-ovatis, applanatulis, brunneis, 10 mm longis, 8 mm latis. 4-1/2 crassibus, laevibus, absque ornamentis. Flores ignoti.

A simili *C. cuneato* differt seminibus majoribus et columellis centralibus capsularibus persistentibus nec caducis.

Type. Frequent along Potaro River above Kaiatuk, Kaieteur Plateau, British Guiana, 10 May 1944, *Bassett Maguire & D. Fanshawe 23352* (holotype, fr. NY).

Distribution. Known only from the type locality.

4. Croton neblinae Jablonski, sp. nov.

Arbor 12 metralis. Stipulis rigidis dense lepidotis, lanceolatis vel cuneatis, 5–6 mm longis, basi 1-1/2–2 mm latis. Petiolis 6–10 cm longis. Laminis ellipticis, apice basique subcuneatis, 9–12 cm latis, 21–25 cm longis, margine integerrimis, rariter undulatis, distante glanduligeris utraque pagina sparse lepidotis, basi eglandulosis vel rariter obsolete biglandulosis, penninerviis. Costis secundariis 8–11 jugis. Inflorescentiis elongatis spiciformibus apice ramulorum ternatim confertis, apice flores ♂, basi ♀, vel saepe glomerulos geminos vel rariter tripligeros, ♀ et ♂ mixtos gerentibus, 22–30 cm longis, fere laxifloris, rariter ♀ et ♂ alternantibus, rhachidibus 2–3 mm crassis teretis (nec sulcatis ut in *C. cuneato*). Bracteis minutis, squamiformibus, triangularibus, 2 mm longis, 1-1/2 mm latis. Floribus vivido-albis. Floribus ♂ facile deciduis, pedicellis, 2–4 mm longis, 0.8–1.0 mm crassis, teretibus, calycibus apertis 9 mm diametientibus, laciniis 5 aequalibus, elliptico-lanceolatis, dorso dense lepidotis interne lanuginosis, 4 mm longis, 2.2–2.5 mm latis, apice subrotundatis vel modice acutis, petalis 5, calycis laciniis angustioribus linearibus, apice rotundatis plus minusve membranaceis secus costas medias uniseriatim lepidotis, staminibus 7–11, plerumque 11, apertis 14 mm diametientibus, receptaculis et partibus inferioribus filamentorum dense pilosis, glandulis 5 ovoideis calycis laciniis appositis. Floribus ♀ pedicellis arcte angulatis, sulcatisve, dense lepidotis, 5–7 mm longis, 1–2 mm crassis, fere persistentibus, stylis 3, basi liberis non in columnam lepidotam coagulatis, bifidis, talis modo stigmata 6 acuta formantibus, calycis laciniis 5, rariter 6, extus fere dense lepidotis, intus glabris in sicco atro-purpureis 5 mm longis, 2–3 mm latis, ovario dense lepidoto, sphaerico, 5 mm diametienti, aequalibus vel leviter inaequalibus disci pulvinulato integro, vel leviter lobato. Fructus ignotus.

Type. Occasional, Cano Grande, southeast of Cumbre Camp, alt. 1100–1150

m, Cerro da la Neblina, Río Yatua, Amazonas, Venezuela, 26 Dec 1957, *Bassett Maguire, John J. Wurdack & Celia K. Maguire 42529* (holotype, fl. NY).

Distribution. Known only from the type locality.

5. **Croton subcoriaceus** Jablonski, sp. nov.

Arbor 7 metralis ramificatione subdichasiali. Ramuli teretes, juveniles lepidoti. Stipulis rigidis, 5–5-1/2 mm longis, subulatis, cito deciduis, juvenilibus tantum visis. Petiolis 2–3 cm longis. Laminis subcoriaceis supra atro-viridibus, subtus pallidioribus, ambitu ellipticis vel leviter obovatis utrinque rotundatis vel subrotundatis, rariter subcuneatis, margine integerrimis, basi glandulas geminas patelliformes gerentibus, penninerviis, costis lateralibus 17–18 jugis, lepidibus 0.2–0.3 mm diametientibus, fimbriatis 32–45 radiatis sparse tectis. Inflorescentiis spiciformibus 12–18 cm longis, apice ramulorum subumbellatim vel pleiochasiter confertis. Spicis unisexualibus omnino masculis vel bisexualibus, apice flores 23–25 masculos, parte inferiore glomerulos bisexuales geminos vel ternos gerentibus. Rhachis profunde sulcata. Bracteis squamiformibus, triangularibus 1.2–1.5 mm longis. Flores (fide collectorum), albi, ♂ pedicellati ♀ sessiles. Floribus ♂ apertis cum staminibus 7–10 mm diametientibus, sepalis ovatis vel obovatis 3-1/2 mm longis, 2-1/2 mm latis, extus dense lepidotis, petiolis membranaceis, fimbriatis, 3-1/2 mm longis, 1–12 mm latis, staminibus 16. Floribus ♀ apertis 9 mm diametientibus, sepalis 5, rariter 6, extus lepidotis intus glabris. Petala minuta. Ovariis 2-1/2 mm altis, 5-1/2 diametientibus, dense lepidotis, stylis 3 liberis in columnam haud aggregatis, bis bifidis eodem tempore 12 crures stigmatales formantibus.

Type. Mouth of Cano Yapacana, Upper Orinoco, alt. 125 m, Amazonas, Venezuela, 18 Jun 1959, *J. J. Wurdack & L. S. Adderley 43028* (holotype, y. fr. NY).

No doubt this new species is closely related to *C. cuneatus* from which it differs by larger flowers and rounded not cuneate leaf base. Spikes 5, subumbellately clustered in a tight pleiochasium.

6. **Croton roraimensis** Croizat, Bull. Torrey Club **67**: 290. 1940.

6a. **C. roraimensis** var. **roraimensis.**

Type. Tree 40 ft high, trunk 10 inch diam, fruit green, southwestern slopes of Mount Roraima, alt. about 7400 ft, Bolivar, Venezuela, 6 Jan 1939, *Albert S. Pinkus 122* (holotype, fr. NY; isotype, ♂ fl. fr. A). Paratype. Petals and stamens yellow, flowers fragrant, *Pinkus 134* (♂ fl. ♀ fl. NY).

Distribution. Collected on Mt. Roraima only: Forested slopes, base of sandstone escarpments, alt. 2040–2255 m, 30 Sep 1944, *Steyermark 58955* (fr. NY); ''Zanjones'' bordering rocky northwest escarpment, alt. 1970 m, 19 Feb 1955, *Steyermark & Wurdack 940* (fl. NY).

The plant is strictly monoecious. Croizat's distinction between pistillate and staminate plants (Bull. Torrey Club **67**: 291) could be misleading. It is a distinct species with the largest known fruit among Guayana Crotons. It is related to *C. cuneatus* from which it differs by the large fruits, and represents with *C. kaieteuri*, *C. neblinae* and *C. subcoriaceus* a group of endemics of high altitudes.

6b. **Croton roraimensis** var. **subinteger** Steyermark, Fieldiana **28**(2): 315. 1952.

Type. Along base of east-facing sandstone escarpments, Ptari-tepui, alt. 2410–2450 m, Bolivar, Venezuela, 7 Nov 1944, *Julian A. Steyermark 29925* (fl. F).

This concept is probably equivalent to the other high altitude endemics belonging to the cuneatus-group, and perhaps should be distinguished with a binomial.

7. **Croton monachinoensis** Jablonski, sp. nov.

Frutex vel arbor monoicus 2–8 m altitudine. Stipulis 6–7 mm longis, a basi triangularibus setaceo-linearibus. Petialis 3-1/2–4 cm longis. Inflorescentiis terminalibus in spicis glomeruliferentibus trini dichasialiter subumbellatim dispositis, spicis centralibus unisexualibus omnino ♂, prius quam lateralibus maturantibus, 25–27 cm longis lateralibus subduplo longioribus, spicis lateralibus bisexualibus, plerumque ♀, apice tantum paucos flores masculos gerentibus, rhachidibus profunde sulcatis, bracteis e basi triangularibus lineari-setaceis, dense lepidotis, 4–5 mm longis. Floribus flavo-viridibus, ♀ oblongis, subsessilibus, calycis laciniis lanceolatis, stylis 3, usque ad basin liberis, haud in columnam coagulatis, bis et ultra bifidis vel palmatim 7–8 divisis. Capsulis trilobatis, lepidosis, 9 mm altis, 9–11 mm diametientibus. Stylis in fructus persistentibus. Seminibus suborbiculato-ellipticis, lenticularibus vel elliptico-ovoideis, dorso convexis, ventro applanatulis, medio leviter carinatis, flavo-brunneis, 9 mm longis, 5-1/2 mm latis.

Type. Locally abundant, Rio Suapure between Raudal Budare and Raudal Pta. Brava, alt. 110–120 m, Bolivar, Venezuela, 17 Jan 1956, *J. J. Wurdack & J. V. Monachino 41251* (holotype, fl. fr. NY).

Distribution. A shrub or tree to 12 m high, occurring at low altitudes. VENEZUELA. Bolívar: Shrub 2.5 m high, flowers green, stem with shrub, occasional, between El Carmen and Raudal Maraca, Río Paraguaza, alt. 110–115 m, Bolívar, Venezuela, 1 Jan 1956, *Wurdack and Monachino 41072* (♂ fl.). Amazonas: Frequent, Río Siapa, Río Casiquiare, alt. 130 m, 3 Apr 1953, *Maguire and Wurdack 34829* (fr.).

This species takes a somewhat intermediate position between *C. matourensis* and *C. cuneatus*. The inflorescence is of the *C. matourensis* type, whereas the seeds are rather like *C. cuneatus*.

8. **Croton matourensis** Aublet, Hist. de Pl. Guian. fr. **2**: 880, *t. 338*. 1775.

C. matourensis α genuinus Müll. Arg. Linnaea **34**: 95. 1865.
C. matourensis γ poeppigianus Müll. Arg. Linnaea **34**: 95. 1865.
C. matourensis δ sericeus Müll. Arg. Linnaea **34**: 95. 1865.
C. impetiginosus Poepp. Baillon Rec. d'obs. **4**: 298. 1864.

Type. ''Habitat in insula Caiennae, & in ripas rivulorum Guianae'' *Aublet s.n.* (photo NY).

Distribution. Tree to 30 m high, 30 cm diam, prominent in upper forest canopy, to an altitude of 700 m; the Guianas, Bolívar and Amazonas, Venezuela, Para, Brazil, and as far southeast as the island of Sao Luiz in the state of Maranhao. FRENCH GUIANA. Godebert, Mar 1920, *Wachenheim 138* (fl. NY). SURINAME. Brownsberg, 3 Jun 1920, *LBB 4696* (fr. NY); Sectie 0, Hoeliaballi, May 1945, *LBB 0310* (fr. NY); 21 Feb 1921, *LBB 518* (fl. NY). Mt. Nassau: forest, km 3.6, Nov 1949, *Lanjouw and Lindeman 2341* (fl. NY), *2484* (fr. NY). BRITISH GUIANA. Ituni, 35 m south of Mackenzie, 17 Jan 1955, *Cowan 39261* (fr.). Southern Pakaraima Mountains: Frequent on sandstone and conglomerate, Kamana Falls, alt. 2200 ft, 24 Aug 1961, *Maguire, Maguire and Wilson-Browne 45933A* (fl. y. fr.); occasional along streamside, Chimapa Creek, alt. 2300 ft, 11 Sep 1961, *Maguire, Maguire and Wilson-Browne 46159A* (fl.); occasional, between Waipa and Sand Hill Rapids, Ireng River, 19 Sep 1961, *Maguire, Maguire and Wilson-Browne 46233* (fl.); Eraidai Savanna, 6 Aug 1957, *Rufus Boyan 90, FD 7914* (fl. NY); dense forest, mouth of Onoro Creek, basin of Essequibo River, lat. 1° 35′ N, 15–24 Dec 1936, *A. C. Smith 2750* (y. fl.). VENEZUELA. Bolivar: Gran Sabana, between Kun and Uaduaru-paru, valley of Rio Kukenan, south of Mt. Roraima, alt. 1065–1220 m, 1 Oct 1944, *Steyermark 59104* (fr. NY); in forests, near St. Elena de Uairen, Alto Caroni, 25 Apr 1946, *Lasser 1520* (fl. NY); in residual forests southeast of St. Elena, 23 Apr 1957, *Bernardi 6745* (fr. NY); forest, 30 km south of El Manteco, alt. 365 m, 9 Aug 1960, *Steyermark 87055* (y. fr. NY); Amazonas: Abundant, Tama-Tama, alt. 150 m, 22 Jun 1959, *Wurdack and Adderley 43155* (fr.). BRAZIL. Para: South woods of I.A.N., Belem, 26 Jan 1943, *Archer 8209* (♂ fl. NY), *Pires 3145* (fl. NY), *51712* (sterile, wood voucher, NY).

Collectors report that the flowers are grayish-green, sometimes white with greenish-gray calyx. The bark has the scent of cloves, and the latex is reddish. The size of flowers and nervature of leaves and persistence of stipules seem to vary with altitude, but more material is needed to decide the taxonomic value of these features.

9. **Croton lanjouwensis** Jablonski, nom. nov.

C. matourensis β benthamianus Müll. Arg. Linnaea **34**: 95. 1865.

C. benthamianus (Müll. Arg.) Lanjouw, Euphorb. of Suriname 17. 1931, non *C. benthamianus* Müll. Arg. Fl. Bras. **11**(2): 106. 1873.

Type. "In Brasiliae septentrionalis prov. Rio Negro propre Barra (*R. Spruce Crot. n. 2*)" (isotype NY, photo NY).

Distribution. This small tree with white flowers seems to be limited to the State of Amazonas, Brazil. BRAZIL. Amazonas: Secondary forest, noninundable, Cachoeira Grande near Manaos, 20 Dec 1936, *Ducke 214*. The Cachoeira Grande specimen has no ♀ flowers, and it remains to be ascertained if the styles are really free to the base, which is, after all, the main distinction of *C. matourensis.*

Croton benthamianus Müll. Arg. is an earlier homonym applied to an entirely different species, related if not identical with *C. palanostigma,* a nonlepidote, palmatinerved species.

10. **Croton icabarui** Jablonski, sp. nov.

Arbor glaberrima. Foliis juvenilibus sparse lepidotis vel pilis stellatis adpressis sparse tectis, maturis glaberrimis, 15–20 cm longis, 5–6 cm latis, lanceolatis, basi cuneatis, biglanduligeribus, subcoriaceis, margine integerrimis, apice acuminatis. Inflorescentiis unisexualibus, ut videtur, verisimiliter dichasialiter dispositis, spicis ♂ 18 cm longis, spicis ♀ 7 cm longis. Floribus ♂ globosis, pedicellis 4 mm longis, staminibus 16. Floribus ♀ 4 mm altis, 4 mm latis, elongato-cylindricis, subsessilibus, vel pedicellis crassiusculis, 1-1/2 mm longis fultis, calycis laciniis 4–5 quincuncialiter valde imbricativis, petalis rudimentariis, lineari-setaceis, rigidiusculis, hispidis, stilibus 3, sessilibus, palmatim 6–8 divisis, arcte involutis, ovario dense stellato-tomentoso, haud depidoto. Fructus ignoti.

Type. Headwaters of Icabaru River, alt. 450–850 m, Bolivar, Venezuela, 9 Jan 1956, *A. L. Bernardi 2853* (holotype NY).

Distribution. Known only from the type specimen. *Croton icabarui* is distinguished from the related *C. matourensis* by its glabrous leaves and the presence of petal rudiments.

11. **Croton pakaraimae** Jablonski, sp. nov.

Croton ex affinitate *C. matourensi*. Arbor 20–40 metralis, trunco 60 cm crassi. Stipulis linearibus rigidulis 9–11 mm longis, cito deciduis. Petiolis 2-1/2–5 cm longis. Laminis ellipticis, 11–13 cm longis, 4-1/2–6 cm latis, basi subrotundatis, apice obtusiusculis vel subcuneatis, margine integerrimis, coriaceis supra glaberrimis, nitidis, subtus virido-leucophyllis, lepidotis, lepidibus brunneis, costis secundariis utrinque 22–30, paene rectis, angulo 70°–80° insertis, basi saepissime eglandulosis, rarissime glandula unica latere costae primariae 1–2 mm supra basin inserta invenitur (in specimine *46023*). Inflorescentiis spiciformibus, glomerulatis ad 40 cm longis, quaterni vel quini apice ramulorum subumbellatim vel pleiochasiter confertis, paene omnino ♂, basi tantum paucos, 3–4 ♀ flores gerentibus, bracteis 8–12 mm longis. Floribus ♂, subsessilibus, apertis 10–12 mm diametientibus, staminibus 11–12. Floribus ♀ apertis 12–13 mm diametientibus, brevissime pedicellis, vix 1 mm longis fultis, stilis absque columellis coarctis, sed distincte liberis, calycis laciniis interne stellato pilosis. Fructus ignoti.

Type. Occasional in margin of woodland, Kopinang Savanna, alt. 900 m, Pakaraima Mountains, 30 Aug 1961, *Bassett Maguire, Celia K. Maguire & G. Wilson-Browne 46023A* (holotype, fl. NY).

Distribution. A tall tree in mixed forests, on laterite, known only from the southern Pakaraima Mountains, British Guiana: Base of Ayanganna, 5 Mar 1960, *Rufus Boyan 126, F.D. 7950* (y. fl. NY); frequent, escarpment to foot of Kopinang Falls, alt. 920 m, 2 Sep 1961, *Maguire, Maguire & Wilson-Browne 46061A* (♂ ♀ fl. NY).

Croton pakaraimae differs from the related *C. matourensis* mostly by the lack of two glands at the leaf base, by a greater number of lateral veins, and by the styles being free at the base.

12. **Croton nuntians** Croizat, Bull. Torrey Club **75**: 402. 1948.

Type. Dicymbe forest, trail from Tukeit to Kaiatuk Falls, Potaro River Gorbe, British Guiana, 28 Apr 1944, *Maguire and Fanshawe 23054-A* (isotype, fr. NY).

Distribution. Known only by the type specimen.

Croton nuntians differs from *C. palanostigma* by its three lobed leaves. The glands at the leaf base are adpressed into the side of the top of the petiole. This species is also related to *C. gossipifolius* of Trinidad and northern Venezuela, but differs in the size of its seeds (about 4 mm long) and by the fact that the tiny warts are arranged in longitudinal rows rather than scattered irregularly.

13. **Croton tonantinensis** Jablonski, sp. nov.

Stipulis deciduis, non visis. Petiolis 5–6 cm longis, apice duabus glandulis stipitatis patelliformibus ornatis. Laminis 17 cm longis, 9–10 cm latis acute trilobatis, basi quintuplinerviis rotundatis non cordiformibus, costis lateralibus 4–5 jugis. Inflorescentiis spiciformibus apice ramulorum quini polychasiter confertis, spicis centralibus 30 cm longis plerumque flores ♂, rariter paucos ♀ intermixtos gerentibus prius quam laterales maturantibus, spicis lateralibus omnino ♀, non-dum apertis, bracteis linearibus, 3 mm longis, 1/2 mm latis, vel trilobis, lobis centralibus lanceolatis 5 mm longis, 1-1/2–2 mm latis, lobis lateralibus setaceo-linearibus 3 mm longis, vix 1/2 mm latis. Floribus ♂ apertis 6 mm diametientibus, laciniis calycinis triangularibus, staminibus 15–16, basi pilosis, petalis 4 mm longis, basi linearibus, apice dilatatis, dense hispidis. Floribus ♀ in axillis bractearum solitariis (in alabastro), 4 mm longis, calycis laciniis valvatis, 10 costatis, pedicellis crassis, 2 mm longis, ovariis dense hisipdis, pilis longis tectis, stilis 3, liberis, 8 fidis, videlicet ter bifidi, cruribus longis helicoido involutis. Capsulis maturis non visis.

Type. Parana de Tonantins, Amazonas, Brazil, 8 Feb 1944, *Ducke 1563* (holotype, fl. NY).

Distribution. Known only by the type specimen.

This species belongs in the *C. gossipifolius* affinity together with *C. nuntians*, differing from both by the stipitate glands of the leaf base. It differs from *C. palanostigma* not only because of its stipitate glands but also because of its trilobate leaves. By means of its stalked glands it has an affinity with *C. turumiquirensis* of coastal Venezuela, but from which it differs by its trilobate leaf and 16 stamens instead of 35, and by the 5 terminal spikes forming a polychasium instead of an umbel.

14. Croton palanostigma Klotzsch, London Jour. Bot. **2**: 48. 1843.

C. benthamianus Müll. Arg. in Mart. Fl. Bras. **11**(2): 105. 1873, non Lanjouw. (Four syntypes quoted: "Habitat in provincia do Alto Amazonas, in silvis Japurensibus: *Martius;* ibidem in vicinia Manaos: *Spruce 1112, 1114;* et in Guayana anglica: *Schomburgk n. 1008.*")

Type. "On the River Padawire, *Schomburgk n. 1008.* In Japura woods, Brazil, *Martius.*" I have seen the syntype of Spruce's "In vicinibus Barra prov. Rio Negro coll. R. Spruce, Dec–Mar 1850–51" marked with a later handwriting "1112 or 1114" (fl. fr. NY), and a photo NY of a Martius specimen marked "in silvis Japurensibus."

Distribution. A small tree to 15 m, upper Amazon River, and Amazonas, Venezuela. BRAZIL. Amazonas: Santa Isabel, Rio Negro, 10 Apr 1929, *Tate 984* (fl. fr. NY); terra firma, near Palmares, São Paulo de Olivença, 11 Sep–26 Oct 1936, *Krukoff 8562* (fl. NY; secondary forest, Estrada do Raiz, 6 Jan 1937, *Ducke 383* (♂ fl. NY). VENEZUELA. Amazonas: Cano Temi, below Yavita, alt. 130 m, 9 Jun 1959, *Wurdack and Adderley 42890* (fl.). Bolivar: Along escarpment, 8 km NW of Kavanayen, alt. 1220 m, 13 Nov 1944, *Steyermark 60467* (NY); Uriman, Cano Anacapa, Rio Apacara, alt. 400–450 m, 15 Aug 1954, *Bernardi 1422* (fl. NY); Rio Blanco, tributary of Rio Icabaru, 16 Apr 1957, *Bernardi 6594* (fl. NY).

I am unable to separate *C. benthamianus* Müll. Arg. from *C. palanostigma.* The distinction given by Müller is based on the sepals being adpressed to the capsules. There is, however, a transition between adpressed and patent sepals even on the same specimen.

The lower part of the individual spikes generally carry both ♀ and ♂ flowers. The ♀ flowers are often conspicuously pedicelled, in some instances as long as 12 mm (*Bernardi 6594*).

C. palanostigma is closely related to *C. gossipiifolius* Vahl. of Trinidad, West Indies and northern Venezuela, from which it differs by lack of lobation of leaves. Both belong to sect. *Cyclostigma* of Müll. Arg. in DC. Prodr. and later renamed as *Eutropia* Müll. Arg. in Mart. Fl. Bras., characterized by the lack of clear segregation of ♀ and ♂ flowers at the base. In Croizat's language *C. palanostigma* is an Amazonian, *C. gossipiifolia* a Caribbean element. Müll. Arg. cites *C. palanostigma* from British Guiana, based on *Schomburgk 1008*. This is an error. Klotzsch clearly states that *Schomburgk's 1008* is from near the River Padawire, a tributary of the Amazon in Brazil, not British Guiana!

15. Croton caryophyllus Bentham, Jour. Bot. Kew Misc. **6**: 374. 1854.

Type. "Rio Negro in viciniis Barra *R. Spruce Crot. n. 4.* Dec–Mar 1850–51" (isotype NY, photo NY).

Distribution. Known only from the type locality.

16. Croton pullei Lanjouw, Euphorb. of Suriname 18, *tab. 3.* 1931.

16a. Croton pullei var. **pullei.**

Type. Goddo, upper Suriname River, Suriname, 26 Jan 1926, *Stahel 76* (holotype ♂ U, isotype y. ♂ fl. U, photo NY).

Distribution. Known only from the type locality.

16b. Croton pullei var. **glabrior** Lanjouw, Rec. Trav. Bot. Neerl. **36**: 698. 1939.

Type. "Expeditio ad fines Surinamensi-Brasilienses designandos, Hab. Tapanahoni R., Kapiea Rapids, oeverbos, Suriname, Reg. *H. E. Rombouts* dd 10 II, 1937, *No. 657*" (holotype fl. U, photo NY).

Distribution. Known only from the type.

C. flavovirens Willd. hb. ined. 17870, *Humboldt 2188* (photo NY) may belong here.

17. Croton longiradiatus Lanjouw, Euphorb. of Suriname 19, *fig. 3a, b, c,* 1931.

Type. Top of Brownsberg, Suriname, 2 Jul 1924, *B.W. 6711* (♂ ♀ U, isotype U, photo NY).

Distribution. Known only from the type locality.

While *Croton longiradiatus* is closely related to *C. pullei* with respect to shape, size, subcordate outline of leaf and biglandularity of leaf base, as well as the axillar disposition of the inflorescence, it differs from *C. pullei* by the more membranaceous texture of the blade and the distinctly three-nerved leaf base. There is also some similarity to *C. caryophyllus* of Belem, Brazil, and *C. billbergicus* of Panama, but differing from these by the obovate shape of the ♂ petals.

18. Croton spruceanus Bentham, Jour. Bot. Kew Misc. **6**: 375. 1854.

Type. "Among inundated rocks at the falls of San Gabriel do Cachoeira of Rio Negro, Brazil, *R. Spruce 2205*" (photo NY).

Distribution. Shrub or small tree, along the Amazon and Rio Negro south to the Bolivian border, north to Cerro Duida. BRAZIL. Terr. Rondonia [Guapore]: Madeira Falls, on Bolivian border, Oct 1886, *Rusby 2622* (♂ ♀ fl. NY). Para: San Miguel, Rio Guama, Jan 1945, *Froes 20267* (♂ ♀ fl. NY). VENEZUELA. Amazonas: Forest, Cano Negro, southeastern base of Cerro Duida, alt. 215 m, 23 Aug 1944, *Steyermark 57912* (fr. NY).

Although Bentham's original description claims "venis . . . infimis, additis interdum utrinque 1–2 tenuibus ex eodem puncto," the photo of the type shows distinctly pennate nervature.

Of special interest is Steyermark's observation on the label of *57912*, from the base of Cerro Duida, that it is a "vining shrub." A similar observation on the related *C. pullei* was made by the collector Stahel (*n. 76*), first accepted, later rejected by Lanjouw (Rec. Trav. Bot. Neerl. **36**: 698. 1939).

I have seen only one fruit (*Steyermark 57912*), and this confirms Bentham's original observation that: "calyx . . . circa capsulam maturam globoso conicus, 7 lin. diametro, capsulam superans. . . ."

19. Croton yavitensis Croizat, Jour. Arnold Arb. **26**: 189. 1945.

Type. Forests of Yavita, alt. 128 m, Amazonas, Venezuela, 28 Jan 1942, *Williams 14029* (holotype fr. A, photo NY).

Distribution. Known only from the holotype.

The material available is too meager to establish the systematic position of this species with certainty. Only 11 leaves and 5–6 capsules with a few seeds are available. The original description is also sketchy. The leaves at the base are not "subauriculatis" but subcordatis. The statement: "stipulis subnullis" is misleading, the fragment of branch is too old and all the stipules are lost. The capsule is 1.5 cm high (not 1.5 mm).

20. Croton polypleurus Croizat, Darwiniana **6**: 457. 1944.

Type. In dense forest, western extremity of Kanuku Mountains, Takutu River, alt. 300 m, British Guiana, 4–22 Mar 1938, *A. C. Smith 3138* (holotype ♂ ♀ fr. A, isotype NY). Paratype. BRAZIL. Terr. Rio Branco: Imelu waterfall, Serra de Rowanoi on the Surumu, Oct 1909, *Ule 7946;* Jan 1909, *7949b* (♂ ♀ NY).

Distribution. Shrub to 3 m, known only from localities indicated by holotype and paratype.

21. Croton kavanayensis Steyermark, Fieldiana Bot. **28**(3): 313. 1952.

Type. Wooded slopes of Quebrada O-paru-ma, between Santa Teresita de Kavanayen and Rio Pacairao, alt. 1065–1220 m, Bolivar, Venezuela, 20–21 Nov 1944, *Steyermark 60386* (sterile holotype F, isotype NY).

Distribution. Tree of 10 m, known only from its type locality. The trunk is made into canoes by the Indians.

Although the general appearance of the leaves reminds one of *C. matourensis*, the indumentum is so different that it can hardly be related to that species. However, the lack of flowers and fruits make it impossible to establish its definite systematic position. Its most likely affinity is *C. polypleurus*.

22. Croton hostmanni Miquel, Linnaea **21**: 477. 1848.

Type. "Crescit in Surinamo (Hostm. 1106 ex Herb. Hook)" (U, K, photo NY).

Distribution. This herbaceous perennial of the savannas, a shrub with spreading branches hardly more than 1 m high, sometimes forming bush islands, seems to be confined to Suriname, British Guiana, and Bolivar and Amazonas, Venezuela. BRITISH GUIANA. Parabaru Savanna, watershed between Rupununi and Kuyuwini Rivers, about 2° 10′ N, 15–17 Feb 1938, *A. C. Smith 3077* (♂ ♀ fl., y. fr. NY); bush island on savanna, Kaieteur Plateau, 7 May 1944, *Maguire & Fanshawe 23291* (♂ fl., fr. NY). Parasura Savanna, alt. 600 m, 7 Dec 1952, *Guppy 630, F.D. 7645* (♂ ♀ fl., y. fr. NY); occasional in open savanna, vic. Hariwa Quarry, 32 mi. S of Mackenzie, 18 Jan 1955, *Cowan 39275* (♂ ♀ y. fl. NY); upper Mazaruni River, 60° 10′ W, 22 Sep–6 Oct 1922, *De La Cruz 2109, 2220* (♂ ♀ fl. NY); occasional in Kamana Savanna, en route to Kopinang Falls, southern Pakaraima Mountains, 28 Aug 1961, *Maguire, Maguire & Wilson-Browne 45971A* (♂ ♀ fl. NY). VENEZUELA. Bolivar: Savanna pasture surrounded by forest, Arabu, alt. 1400 m, Mt. Roraima, 1927, *Tate 271* (♂ ♀ fl. NY); Urkara Falls, Rio Caroni, alt. 480 m, 6 Oct 1946, *Cardona 1740* (♂ fl. NY). Amazonas: Locally abundant on open laja, 8 km below Raudal Galineta, alt. 130–300 m, Rio Siapa, Jul 1959, *Wurdack & Adderley 43507* (♂ ♀ fl., fr. NY).

Miquel quotes this species only from Suriname, and Lanjouw, who has seen Miquel's original, considers it to be endemic there. However, I have not seen a single specimen from Suriname; neither has Lanjouw with the exception of Miquel's type. According to Müll. Argoviensis, *C. hostmanni* should have all 5 sepals of equal size, which is not the case with any specimen examined by me. They all show two large and three small ones, or one large and four small sepals. He also describes the leaf tip as being obtuse or even emarginate, which agrees with the photograph of the type. But because of a high variability of the leaf shape, this distinction can hardly be considered critical. Croizat thinks ''a rufus cast on innovations and youngest leaves distinguishes this species from its allies'' (meaning probably *C. subincanus*).

23. Croton subincanus Müll. Arg., Linnaea **34**: 139. 1865.

Type. ''In Guayana anglica (*Schomb. n. 665! Rich. Schomb. n. 1029!*)'' (photo NY).

Distribution. Bushy herb or shrub 1–3 m high, along stream course and rocky ledges in British Guiana, Bolivar, Venezuela, and Territorio do Rio Branco, Brazil. BRITISH GUIANA. Dense forest, northwestern slopes of Kanuku Mountains, Moku-moku Creek, Takutu tributary, alt. 150–400 m, 31 Mar–16 Apr 1938, *A. C. Smith 3394* (♂ ♀ fl. NY). VENEZUELA. Gran Sabana, south of Mt. Roraima, Rio Kukenan, alt. 1065–1220 m, Bolivar, 1 Oct 1944, *Steyermark 59052* (♀ fl. NY). BRAZIL. Frequent along stream course, Serra Tepequem, alt. 1130 m, Terr. do Rio Branco, 29 Nov 1954, *Maguire & Maguire 40097* (♂ ♀ fl., fr. NY).

The three specimens seen by me differ from *C. hostmanni* by a distinctly woolly indumentum on the lower side of the leaf. But I am not at all certain whether this represents a good enough distinction and whether this binominal will not have to be reduced to *C. hostmanni* after intensive collecting and study.

Müller Argoviensis places this binominal into sect. *Decarinus,* which is characterized by the inequality of calyx lobes, whereas he places *C. hostmanni* into sect. *Eucroton* which has equal calyx lobes.

Lanjouw who has examined the *C. hostmanni* original makes no mention of equality of calyx lobes and bases the distinction on the obtuseness of leaves in *C. hostmanni* and acuteness in *C. subincanus,* which by itself is a very unreliable feature.

24. **Croton spiraeifolius** Jablonski, sp. nov.

Frutex 0.5–2 m altitudine. Stipulis minutis, minus quam 1 mm longis, setaceis, rigidis, dense pilosis. Petiolis 2–2.5 mm longis, sub apice glandulosis, glandulis flavibus, binis, latere insertis. Laminis ellipticis rariter lanceolatis, 2–4.5 cm longis, 1.5–2.5 cm latis, basi rotundatis vel subcuneatis, apice obtusis, brevissime mucronulatis nonnunqam leviter tridentatis, margine integerrimis vel superiore parte repando serrulatis, atque saepe repando flaveo glandulosis, utraque pagina sparse pilis irregulariter pauco ramosis obsitis penninerviis vel basi subtrinerviis, nervis lateralibus 7–10 jugis. Inflorescentiis spiciformibus terminalibus, foliorum apices aequantibus vel subaequantibus rariter modice superantibus, 2–5 cm longis. Floribus flavis vel albis. Floribus ♂ ad 1.5 mm longis, laciniis calycinis 4–5 suborbicularibus stellato pilosis, in alabastro valde imbricativis, petalis 4–5 membranaceis, glabris suborbicularibus, staminibus 7–12, glandulis petalis alternantibus, sphaericis, flavibus. Floribus ♀ infimo basi spicarum solitariis, in axillis bracearum linearium, canaliculatum 3 mm longorum 0.7 mm latorum, calycis laciniis 5–6, rariter 7, inaequalibus, verticaliter adscentibus 2–3 mm longis, latitudine variabilibus inter 0.7 et 1.8 mm, stylis palmatim 6-fidis vel ter bifidis, 2 mm altis, discis squamuliformibus. Capsulis viridibus, 7–8 mm altis, pilis stellatis centro longe armatis tectis. Seminibus 3 × 4 mm, longitudinaliter striatis, dorso ex ca. 22 rugulis strias minutas formantibus.

A *C. hostmanni* quam nonnullis aspectibus accedit, arcte differt glandulis non in basi laminae sed apice petiolorum insertis, floribus ♀ in basi spicarum solitariis, foliis apice obtusis mucronulatisque, sparse pilosis pilis stellatis irregulariter radiantibus, radiis paucis, non plus quam 2–3.

Type. Occasional on Savanna 3, Cerro Yapacana, alt. 800–1000 m, upper Rio Orinoco, Amazonas, Venezuela, 1 Jan 1951, *Bassett Maguire, R. S. Cowan & J. J. Wurdack 30571* (♂ ♀ fl., fr. NY).

Distribution. Shrub 0.5–2.0 m high, endemic in the savannas of the upper Orinoco. VENEZUELA. Amazonas: Locally frequent along trail to Yapacana gold mine, alt. 150 m, 17 Mar 1953, *Maguire & Wurdack 34527* (♂ fl. fr.); occasional in Yapacana Savanna 3, base of Cerro Yapacana, alt. 125 m, 29 Nov 1954, *Maguire, Wurdack & Bunting 36578* (♂ fl. fr.); 16 Sep 1957, *Maguire, Wurdack & Keith 41543* (♂ ♀ fl. fr.); locally abundant on savanna margins, Cano Cumare, 20 km above San Fernando de Atabapo, Rio Atabapo, alt. 125 m, 3 Jun 1959, *Wurdack & Adderley 42751* (♂ ♀ fl. fr.).

This well defined species shows little variation in the shape and size of the leaves, with the exception of the collection from Rio Atabapo (*no. 42751*) which has somewhat narrower leaves.

25. **Croton subserratus** Jablonski, sp. nov.

Frutex parvus, stipulis setaceis 1–2 mm longis fere persistenibus. Petiolis 5–6 mm longis apice stipitato biglandulosis. Laminis ovatis, 4–5 cm longis, margine grosse serratis, pilis pauci-radiantibus utrinque pagina parce tectis, nerviis secundariis 5–6, basi distincte trinerviis. Inflorescentiis spiciformibus, 4–7 cm longis terminalibus inter flores ♂ et ♀ interrupto-nudis, femineis basi solitariis. Bracteis triangularibus, apice setaceis, 1-1-1/2 mm longis. Floribus ♂, 2 mm diametralibus, pedicellis 1–2 mm longis fultis. Floribus ♀ tantum sub capsulis visis, laciniis calycinis valde inaequalibus, accrescentibus, 5–8 mm longis. Capsulis 8 mm altis, pilis stellatis dense tectis. Pili partiales subinde circa pilum terminalem radiantes.

Seminibus atro-brunneis 5–6 mm longis, 4 mm latis, minutissime rugulosis, rugulis in lineas longitudinales dispositis.

Similis *C. sipaliwiensi* a quo differt capsulis tomentosis, inflorescentis longioribus, foliis majoribus, glandulis suprapetiolaribus distincte stipitatis.

Type. Summit, Cerro Guanay, alt. 1800 m, Amazonas, Venezuela, 2 Feb 1951, *Bassett Maguire, Kathleen D. Phelps, Charles B. Hitchcock & Gerald Budowski 31731* (holotype ♂ fl., fr. NY).

Distribution. Known only from the type locality.

26. Croton sipaliwiensis Lanjouw, Rec. Trav. Bot. Neerl. **36**: 698, *fig. 1,* 1939.

Type. Savanna above Camp 11, Brazilian-Suriname boundary survey, Sipaliwini River, Suriname, 10 Dec 1935, *Rombouts 357* (holotype ♂ ♀ fl., fr. U, photo NY).

Distribution. Shrub of savannas and sandy river banks, known only from Suriname. "Gandavoetoe val, Bo.—Tapanahony R," Aug 1959, *Schulz 8211* (♂ fl., fr. U).

This species is probably closely related to *C. subserratus,* differing only in the smaller leaves, shorter glands at the top of the petiole, and especially by the glabrous ovary. It is also related to *C. lundianus* and *C. sclerocalyx* (Diedrich) Müll. Arg., both of central Brazil.

27. Croton suavis Kunth, HBK. Nov. Gen. et Spec. Plant. **2**: 76. 1817.

Type. "Crescit prope Cumana in siccis (Prov. Novae Andalusiae) Floret Septembri" (B, photo NY).

Distribution. Besides Venezuela, this shrub of savannas, river banks and flood sands, is reported from British Guiana and the Rio Negro, Brazil. BRAZIL. Muya penima, Rio Negro, Amazonas, 4 Sep 1928, *Tate 66, 68* (♂ fl., fr. NY).

Müller reported Kunth's original Humboldt specimen to be in Berlin under *Willd. fol. 17852.* Gleason saw this material in Berlin and identified *Tate 66* and *68* by comparison.

28. Croton mollis Bentham, Jour. Bot. Kew Misc. **6**: 375. 1854.

Type. Near Manaos, Amazonas, Brazil, Oct 1851, *Spruce 1806* (isotype, photo NY).

Distribution. A 1–3 m shrub known only from the upper Amazon region. BRAZIL. Amazonas: Pataua, between Tapuruquara and Barcelos, Rio Negro, 4 Oct 1947, *Pires 657* (♂ fl. NY, ♂ ♀ fr. U).

Croton mollis is closely related to *C. suavis,* differing by having 2 (rather than 4) stipitate glands at the top of the petiole, longer hairs in the indumentum, and narrower leaves. Further collection and study may prove these two species to be conspecific.

29. Croton nervosus Klotzsch, Lond. Jour. Bot. **2**: 50. 1843.

C. nervosus β pubescens Klotzsch, Lond. Jour. Bot. 50. 1843 (Rio Takutu, *Schomburgk 802*).
C. nervosus β villosus Klotzsch, Lond. Jour. Bot. 2: 50. 1843 (Essequibo, *Schomburgk 44*).
C. argyrophyllus β pubescens Müll. Arg., Linnaea 34: 96. 1865 (*Schomburgk 802*).
C. argyrophyllus α villosus Müll. Arg., Linnaea 34: 96. 1865 (*Schomburgk 44*).
C. micans α genuins Müll. Arg. pr. p. in DC. Prodr. 15(2): 554. 1866; in Mart. Fl. Bras. 11(2): 122 (*Rob. Schomburgk 44, Rich. Schomburgk 32a, 33*).
C. micans β pubescens Müll. Arg. in DC. Prodr. 15(2): 554. 1866; in Mart. Fl. Bras. 11(2): 122 (*Schomburgk 802*).

Type. Essequibo River, British Guiana, *Rich. Schomburgk 802, Rob. Schomburgk 44.*

Distribution. In addition to the type locality, also known from Vichada, Venezuela. BRITISH GUIANA. Kuyaliwak Falls, lat. 4° 53′, Essequibo River, British Guiana, 1 Oct 1937, *Smith 2155* (♂ ♀ fl. NY). VENEZUELA. Locally common on sandy beaches of the Rio Vichada, 6 km W of San Jose de Ocune, Amazonas, 23 Jan 1944, *Hermann 11085* (♂ ♀ fl. NY).

The leaves of the Venezuelan specimen are silvery lepidote below and verrucose above, with the diameter of the lepides not exceeding 0.2 mm. The Essequibo specimen has a very different indumentum, and the stellate hairs being more than 0.4–0.5 mm in diameter.

30. **Croton sacaquinha** Croizat, Darwiniana **6**: 457. 1944.

Type. Circa urbem culta et subspontanea, Manaos, Amazonas, Brazil, Sep 1935, *Ducke 384* (♂ ♀ fl. fr. isotype NY).

Distribution. A small tree known only from the type, and belonging to the *C. nervosus*-group. It bears some similarity to *C. potaroensis,* while differing from it, according to Croizat, by less adscendent side veins, filiform stipules, by indumentum and ♀ flowers.

31. **Croton potaroensis** Lanjouw, Meded. Bot. Mus. Utrecht **12**(31): 457. 1934.

C. bartlettii Lanjouw, Meded. Bot. Mus. Utrecht **12**(31): 460. 1934. Type. Akawing Falls, Cuyuni River, British Guiana, fl. Oct. 1904, *Bartlett 8082* (K).

C. cardonei Croizat, Bol. Soc. Venez. Ci. Nat. **11**: 79. 1947. Type. *Gleason 329* (K, isotype ♂ ♀ fl. NY).

Type. Tumatumari, bank of Potaro River, British Guiana, 4–6 Jul 1921, *H. A. Gleason 329* (holotype K, isotype NY).

Distribution. Shrub 1–2 m, rarely a tree 4 m, British Guiana, Bolivar and Amazonas, Venezuela. BRITISH GUIANA. Potaro River: Tumatumari, 20 Sep 1923, *Linder* (♂ ♀ fl. NY); on rocks along river, Amatuk, 31 Aug 1937, *Sandwith 1245* (♂ ♀ fl. NY). VENEZUELA. Bolívar: Río Caroní, Camp Uriman, alt. 380–400 m, 7 Sep 1954, *Bernardi 1678* (♂ y. fr. NY); Uriman Savanna, alt. 400 m, 18 Sep 1946, *Cardona 1611* (♂ ♀ fl. fr. NY); rapids of Kurukuya, alt. 740 m, 9 Oct 1946, *Cardona 1781* (♂ fl. NY); Maria Esperma Falls, base of Sierra Ichun, Ichun River, tributary of Río Paragua, alt. 500 m, 28 Dec 1961, *Steyermark 90306* (♂ fl. NY). Amazonas: Common on rocks, Culebra Rapids, Rio Cunucunuma, alt. 150 m, 23 Dec 1950, *Maguire, Cowan & Wurdack 30349* (fr.); locally frequent on rocky island, between Raudal Gallineta and Salto Gallineta, alt. 120–130 m, Río Siapa, 19 Jul 1959, *Wurdack and Adderley 43499* (♂ fl. NY).

The British Guiana specimens have narrow lanceolate leaves; the Bolivar specimens have ovate leaves 2–3 cm wide. The leaves of the Amazonas plants are smaller than those from Bolívar, being 7–11 mm wide and 2.7–4.0 cm long. Collection No. *43499* is penninerved throughout.

32. **Croton bolivarensis** Croizat, Jour. Arnold Arb. **21**: 89. 1940.

Type. Santa Catalina, Delta Amacuro, lower Orinoco, Venezuela, 1896, *H. H. Rusby & Roy W. Squires 278* (holotype A, isotype ♂ ♀ fl. NY).

Distribution. Small shrub on the lower Orinoco. VENEZUELA. Bolívar:

Ciudad Bolívar, 8–11 Jun 1931, *Holt & Blake 861* (♂ ♀ fl. NY); between Upata and Guasipati, 12 Apr 1957, *Bernardi 6476* (♂ NY).

Bernardi 6476 has been tentatively included in this species. The ♂ flowers are 2 mm in diam. when open, the leaves 6 × 15 mm, base of leaf-blade eglandulose, with stipules fallen off. This specimen also has many characteristics of *C. suavis,* but differing from it by lack of glands at the base of the blade and a more lanuginose rather than lepidote stellate indumentum. It may represent a new species, but the material is too inadequate for proper evaluation.

33. **Croton stahelianus** Lanjouw, Euphorb. of Suriname 17, *fig. 2,* 1931.

Type. Upper Koetarie R., Suriname, Oct, *BW 7002, Stahel 611* (fl. fr. U).

Distribution. Shrub 1.0–1.5 m high, known only from Suriname. SURINAME. Frequent in lower part of mountain, Voltzberg, 19 Sep 1933, *Lanjouw 902* (♂ fl. NY); granite plateau near km 8, in line from Paka paka on the Saramacca River to Ebbatop, Van Asch van Wijcks Range, 9 Feb 1951, *Florschütz 1291* (sterile, NY).

34. **Croton cajucara** Bentham, Jour. Bot. Kew Misc. **6**: 376. 1854.

Type. "On the Lago de Quiriquiry near Obidos," Para, Brazil, and Müll. Arg. adds: "*Spruce 195* in hb. Hooker" (photo NY).

Vernacular name: Cajucara.

Distribution. Shrub 10–15 ft high. In addition to the State of Para, known also from Maranhao and Mato Grosso, Brazil.

35. **Croton arirambe** Huber, Bull. Soc. Bot. Geneve ser. 2, **6**: 182. 1915.

Type. "Habitat in regione fl. Arirambe superioris," tributary of R. Cumina, N of Obidos, Para, Brazil, Dec 1960, *Ducke.*

Distribution. Known only from two widely separated localities both in Para, Brazil. The one specimen examined is BRAZIL. Pará: On sandstone, Tapajos, Rio Cururu, Erereri, 25 Jul 1950, *Egler 1030* (♂ ♀ fl. NY).

This is a well marked species with glandulose dentate leaf margins, and fimbriate glandulose stipules. It stands well isolated among the Guayana species, but shows definite relationship to the south Brazilian *C. serratifolius* Baill.

36. **Croton essequiboensis** Klotsch, Lond. Jour. Bot. **2**: 49. 1843.

C. populifolius β essequiboensis Müll. Arg. in DC. Prodr. **15**(2): 654. 1866.

Type. "On the Essequibo, *Schomburgk n. 33.*"

Distribution. Shrub to 2 m high, known only from the Essequibo and Potaro Rivers. BRITISH GUIANA. Kuriki Falls, Essequibo River, 15 Aug 1952, *Jonah Boyan 22—F.D. 7056* (♂ ♀ fl. fr. NY).

This species, conspicuous by the deeply incised bracts and fimbriate-glandular calyx lobes, is related to the N Venezuelan and West Indian *C. populifolius.*

37. **Croton tafelbergicus** Croizat, Bull. Torrey Club **75**: 401. 1948.

Type. Opening in medium bush, 1.5 km S of East Ridge, Tafelberg, Suriname, alt. 920 m, 1 Sep 1944, *Bassett Maguire 24582* (isotype ♂ ♀ y. fr. NY).

Distribution. Small tree to 4 m high, endemic on Tafelberg. Tafelberg: Kappel Savanna, southern base of mountain, uncommon, sandstone, alt. 300 m, 20

Feb 1961, *Kramer & Hekking 2947* (♂ ♀ fl. fr. NY); rare shrub to 2 m, Savanna II, 17 Aug 1944, *Maguire 24402* (♂ ♀ fl. fr. NY).

There is a well developed falcate appendix, 2.0–2.5 mm long, between the calyx lobes of the ♀ flower which distinguishes this species from all other Crotons. *Maguire 24402* has much smaller leaves than the type, and in many respects resembles *C. essequiboensis.*

38. Croton hirtus L'Heritier, Stirpes novae. 17, *tab. 9.* 1785.

C. glandulosus α hirtus Müll. Arg. in DC. Prodr. **15**(2): 684. 1866.
C. glandulosus η subincanus Müll. Arg. in DC. Prodr. **15**(2): 685. 1866.

Type. "Habitat in Guiana. *Lud. Richard.*"

Distribution. Common annual distributed through the Guianas, north and central Brazil. SURINAME. Marowijne River: Albina, Jul 1904, *Versteeg 527* (fr. NY); Paramaribo: On the 2nd or Oude Ryweg, 23 May 1916, *Samuels 183* (♂ ♀ fl. NY); Zanderij forest, 3 Jul 1916, *Samuels 498* (♀ fl. NY); forest en route to Kwatta farm, 27 Apr 1916, *Samuels 77* (♂ fl. NY); Charlesburg Rifl, 5 Apr 1944, *Maguire and Stahel 22757* (fr.); Jacob Kondre village, 15 Jun 1944, *Maguire 23803* (fr.). FRENCH GUIANA. Cayenne, 11 May 1921, *Broadway 167* (♀ fl. fr. NY). BRAZIL. Para: vic. Santarem, Nov–Mar 1845–50, *Spruce 193* (fr. NY); Belem: south woods Instituto Agronomico do Norte, 21 Jan 1943, *Archer 8149* (♂ ♀ fl. NY). VENEZUELA. Delta Amacuro: Cano del Uricoa-San Antonio, 16–19 Feb 1911, *Bond, Gillin & Brown 141* (fr. NY).

Croton hirtus is closely related to if not identical with *C. glandulosus L.,* distributed throughout the West Indies, Mexico, northern Venezuela, Colombia, Ecuador and Peru.

39. Croton miquelensis Ferguson, Missouri Bot. Gard. Ann. Rep. **12**: 49. 1901.

C. chamaedrifolius Griseb., Fl. Brit. West Ind. 41. 1864, exl. syn. Sloan; Müll. Arg. in DC. Prodr. **15**(2): 686, 1866 "non Lamarck qui Acalyphae spec."

Type. There is some doubt with regard to the typification of this binomial. Ferguson designated none. He based his binominal on Müller's recognition that Lamarck's *C. chamaedrifolius* is not a *Croton* but an *Acalypha.* According to Müller, this species grows "In insulis Trinitatis, Haiti (ex Griseb.), in Nova Granata (*Holton n. 849*), ad Bogota (*Triana*), in Venezuela (*Bertero, Otto*), in Surinamia (*Kappler n. 1417*), in Guyana anglica (*Parker, Schomburgk n. 241, 480*) et in Brasilia secus flumen Amazonicum (*Poepp. n. 2603*)." All of these, then, should be considered syntypes.

Distribution. Annual weed to 1.2 m tall, distributed in the West Indies, northern Venezuela, Colombia, Guianas, along the Orinoco in Venezuela, to the Amazon and Rio Negro, Brazil. SURINAME. Forest of La Poule plantation, 23 Apr 1916, *Samuels 40* (fr. NY); burnt savanna, Tibi Savanna, 6 Jan 1949, *Lanjouw and Lindeman 1648* (fr. NY); on islet in Armina Falls, on clay soil, Marowijne River, 9 Feb 1949, *Meijer 1984* (fr. NY). FRENCH GUIANA. Cayenne, 3 Jun 1921, *Broadway 116, 404* (♂ ♀ fl. NY). BRITISH GUIANA. Coast, Jun 1888, *Jenman 4443;* Lamehan Canal, Oct 1888, *Jenman 4560;* Parika, 18 mi W of Georgetown, Essequibo River, 14 Nov 1919, *Hitchcock 16752* (fl. ♂ ♀ fr. NY); Rockstone village, 13–30 Jul 1921, *Gleason 641* (♂ fl. fr. NY). BRAZIL. Amazonas: Rio Negro: 1907–1908, *Weiss & Schmidt s.n.* (♂ ♀ NY); Camanaos, 22–23 Dec 1930, *Holt & Blake 571* (♂ fl. fr. NY). Pará: Ilha de Mosqueiro, vic.

Belém, sandy coast, 3–9 Nov 1929, *Killip & Smith 30386, 30444* (fl. fr. NY); Instituto Agronomico do Norte, Belém, 6 Mar 1944, *Silva 163* (fr. NY). VENEZUELA. Delta Amacuro: Sacupana, Apr 1896, *Rusby & Squires 29* (fr. NY). Amazonas: Boca del Vichada, alt. 100 m, Río Orinoco, 12–24 Jan 1930, *Holt & Gehriger 226* (fr. NY); San Carlos, alt. 100 m, Rio Negro, 27 Jan 1931, *Holt & Blake 639* (fr. NY); 10 km S of Puerto Ayacucho, 31 Sep 1960, *Foldats 3593* (fr. NY); mouth of Rio Pamoni, alt. 130 m, 2 Apr 1953, *Maguire & Wurdack 34786* (fr. NY).

40. Croton lobatus L., Sp. Pl. ed. 1. 1005. 1753.

C. lobatus θ genuinus Müll. Arg. in DC. Prodr. 15(2): 669. 1866.
Type. "Habitat in Vera Cruce."

Distribution. Annual weed known throughout Tropical America. BRITISH GUIANA. Golden Grove, Georgetown, Nov 1905, *Bartlett s.n.* (♂ ♀ fl. fr. NY); Mahaica, on coast, 15 Nov 1919, *Hitchcock 16774* (♂ ♀ fl. NY); Berbice, 1926, *Leon 171* (♂ ♀ fl. fr. NY); Kamuni Creek, Groete Creek, Essequibo River, 21 Apr 1944, *Maguire & Fanshawe 22933a* (♂ ♀ fl. fr. NY); Demerara, 2 May 1958, *Harrison 882* (♂ ♀ fl. NY). BRAZIL. Pará: Belém, 14 Oct 1942, *Archer 7668* (♂ ♀ fl. fr. NY), *Killip & Smith 30305* (♂ ♀ fl. fr. NY); Obidos, *Spruce 192* (♂ ♀ fl. fr. NY).

Appendix

For an appendix are left 12 binominals and one trinominal, of which no herbarium specimens were available. A further disposition of these will have to be left for a study in European herbaria. Two binominals: *C. alnoides* and *C. hadriani* are reported doubtfully from N Brazil. Five are from the State of Para, Brazil, three from the Guianas, three were collected along the Orinoco in Venezuela. The probable relationship and position in the key based on description and on photos is indicated below.

41.	*C. martii* Müll. Arg.	related to	2.	*C. cuneatus*
42.	*C. calycularis* Hubert	related to	2.	*C. cuneatus*
43.	*C. alnoides* Baill.	related to	15.	*C. caryophyllus*
44.	*C. guianensis* Aubl.	related to	18.	*C. spruceanus*
45.	*C. scleroxalyx γ pubescens* Müll. Arg.	related to	22.	*C. hostmanni*
46.	*C. galeopsifolius* Lanj.	related to	23.	*C. subincanus*
47.	*C. hadriani* Baill.	related to	28.	*C. mollis*
48.	*C. orinocensis* Müll. Arg.	related to	29.	*C. nervosus*
49.	*C. amazonicus* Müll. Arg.	related to	29.	*C. nervosus*
50.	*C. umbratilis* H.B.K.	related to	34.	*C. cajucara*
51.	*C. crenatus* Müll. Arg.	related to	35.	*C. arirambe*
52.	*C. asperrimus* Benth.	related to	36.	*C. essequiboensis*
53.	*C. scordioides* Lam.	related to	39.	*C. miquelensis*

Julocroton Martius, Flora 20, 2, Beibl. 119. 1837.

Julocroton is closely related to *Croton*, differing from it mainly by the congested inflorescence in which the flowers are sessile and strongly appressed to the rhachis. As a result, the flowers, especially the ♀ ones, assume a bilateral symmetry. The ventral or adaxial side of the perianth is strongly reduced, the two

lobes becoming minute scales or disappearing entirely, whereas the three dorsal or abaxial lobes develop strongly, and are in all cases pennately dissected.

The center of development of *Julocroton* is southern Brazil, Paraguay and Argentina, the Andes, Central America and Mexico as far north as southern Texas. From northern Brazil it extends to the Guayana Highland, but is not known in northeastern Venezuela and the West Indies. Until recently, *Julocroton* has not been known from Guayana.

1. **Julocroton vergarenae** Jablonski, sp. nov.

Fruticulus ad 2.5 metralis, ramificatione plerumque opposita. Ramuli juveniles teretes, rarius angulati, virides, pilis stellatis, 0.6–0.8 mm diametralibus sparse tecti. Petioli ad 5 cm longi, stipulis duabus triangularibus sive linearibus, 7–8 mm longis, 1–1.2 mm latis caducissimis muniti. Folia inferna subopposita, superiora alternantia, laminis late cordatis, ad 18 cm longis, vulgo 13 cm longis, 7–13 cm latis, basi cordatis, eglandulosis, utraque paginis viridibus, subtus nonnihil pallidioribus, supra 20–22 verruculis pro mm quadr., hic-inde 2–3 pilis stellatis pro mm quadr., 0.25–0.3 mm diametralibus, 8–9 radialibus ornatis, subtus autem pilis stellatis multo majoribus, 0.5–0.6 mm diametralibus, 8–9 radialibus, densior, videlicet 15–16 pro mm quadr. obsitis, basi quintuplo-septuplonervius.

Inflorescentiae more generis densiuscule spicatae, breves, vix ultra 4–5 cm longitudine, spicis dichasialiter vel rarius pleiochasiter apice ramulorum confertis, spicis centralibus 3–5 cm longitudine prius quam laterales maturantibus, omnino ut videtur floribus ♂ compositis, spicis lateralibus 2.3–2.5 cm longis, 1.5 cm crassis bisexualibus superiore parte flores ♂, inferiore parte flores ♀ gerentibus, bracteis infimis tri- vel bi-partitis, ceteris linearibus 4–7 mm longis, falcatis vel leviter inflexis, apice cucullatis, setaceisque, dorso secus costam mediam glanduloso-pilosis.

Flores ♂ (juveniles tantum visi) 5–5.5 mm longitudine, 1 mm crassitudine, bilateraliter symmetrices vel modice irregulares, calycis laciniis 5 modice inaequalibus, dorsalibus tribus lanceolato-linearibus, cucullatis, 4.5–5 mm longis, ventralibus duabus brevioribus, rariter omnibus 5 subaequantibus, longiuscule cucullatis, petalis 2.5 mm longis, 2 mm latis, deltoideis, lateraliter connatis, membranaceis, medio costis centralibus margineque incrassatis, apice in setas acutas productis, glandulis extrapetaloideis, 5, squamuloso-rhomboideis.

Flores ♀ 9 mm longitudine, sessiles, ad rhachides adpressi, calycis laciniis valde inaequalibus, dorsalibus tribus, pennato-laciniatis, 6.5 mm longis, ventralibus duabus abortivis, minutiusculis ad rhachidem adpressis, disco hypogyno 2.2 mm lato, arcte tri-lobato, lobis 1.5 mm longis, margine incrassatis, aurantiacis. Capsula 4.8–5 mm altitudine, stellato pilosa, pilis 6–8 rameis, 0.6–0.7 mm diametientibus. Semina verrucosa, vel ruguloso-aspera, lucidula, ovoidea, 3.5 mm longitudine, 2.5 mm latitudine, rugulis dorsalibus circiter 150 irregulariter dissitis, ventralibus circiter 160 in 15–16 series obsoletis dispositis.

Species a simili *C. triquetro* disco hypogyno antice arcte lobato, a *J. montevidense* foliis lato-cordatis multoties majoribus, a *J. rambo* foliis margine integerrimis differt.

Type. 12 km E of Hato la Vergarena, headwaters of Rio Saca, Bolivar, Venezuela, 17 Oct 1954, *John J. Wurdack and Guppy 58* (♂ ♀ fl. fr. NY).

Distribution. Known only from the type locality.

2. Julocroton aff. **hondensi** (Karst.) Müll. Arg. in DC. Prodr. **15**(2): 704. 1866.

Differt a precedenti foliis minoribus, 6–7 cm longis, 4.5–5.6 latis, disco hypogyno leviter tantum undulato non arcte trilobato. Fruticulus 7–12 pedalis. Inflorescentia alba. Semina juvenilia haud satis evoluta tantum visa.

Distribution. VENEZUELA. Bolívar: in forest between La Paragua et El Cristo, alt. 290 m, 25 Apr 1943, *Killip 37615* (♂ ♀ fl. fr. y. fr. NY).

Croizat in Revista Argent. Agron. **11**(2): 99. 1944 cites this specimen and compares it with *J. hondensis* of Tolima, which, on the other hand he identifies with *J. triqueter* var. *gracilis* Müll. Arg. Because of the inadequate material, I agree with Croizat that this specimen should not be named and typified.

Senefeldera Martius, Flora 24, Beibl. **2**: 29. 1841.

Sennefeldera Endl., Gen. Suppl. **2**: 88. 1842; Baill. Etude. Gen. Euphorb. 535. 1858.

Type species. *S. multiflora* Martius.

This genus is confined to South America between 10° N and 24° S latitudes, east of the Andes. Its center of development is in the Amazon Valley, with two isolated outliers, one in southeastern Brazil and the other in the Maracaibo Basin.

The delimitation of *Senefeldera* based on the stamens being more than 3 appears to be artificial. The random addition of new species, often with inadequate material, has greatly enlarged the concept and made its distinction from *Actinostemon, Gymnanthes, Sapium* and *Sebastiana* obscure. Revision of these genera is needed before a more definite circumscription of *Senefeldera* can be given.

Key to the Species of *Senefeldera*

1. Stamens less than 15 (unkown in *S. nitida* and *S. karsteniana*).

2. Seeds on dorsal side not sharply apiculate. (Rarely indistinctly apiculate in *S. inclinata* and *S. macrophylla.* Unknown in *S. triandra, S. nitida* and *S. contracta.*)

3. Style, stout, short (0.5–2.0 mm).

4. ♂ flowers erect on pedicel. Base of upper side of midrib with a central gland.

5. Stigmas stout, much shorter than the ovary.

6. ♂ pedicel stout, shorter than the flower. Number of stamens 8–13. Stigmas acute, recurved. Capsule 5–7 mm high. SE Brazil. 1. *S. multiflora.*

6. ♂ pedicel slender, about length of ovary or longer. Stamens 6. Stigmas stout, straight, laterally compressed. 2. *S. triandra.*

5. Stigmas slender, falcate, longer than ovary. Stamens 4–6. Maracaibo Basin. 3. *S. testiculata.*

4. ♂ flowers inclined, i.e., the disklike calyx attached sidewise to the pedicel. Base of upper side of midrib without a central gland. Stamens 4. Stigmas flat, short, with blunt or slightly dilated tip. Capsules large (1.5 cm high). Amazon Valley. 4. *S. macrophylla.*

3. Style slender, 6–7 mm long. Base of upper side of midrib without a central gland.

7. Leaves chartaceous, cuneate at the eglandular base. ♂ flowers inclined, i.e., attached sidewise to the pedicel. Stamens 8–10. Seeds somewhat apiculate on the back. Upper Orinoco, Venezuela. 5. *S. inclinata.*

7. Leaves chartaceous or coriaceous, rounded at the base, these ventrally inconspicuously glandular on both sides of midrib. Flowers 3 per cymule. Stamens 3–10 per flower.

8. Leaves coriaceous shiny. Perianth of ♂ flowers consist of 1 dorsal deltoid bractlike sepal. Filaments short. Style 6–7 mm long, persistent on capsule. Capsule 1.5 mm high, 2.5 cm wide, lobes not carinate. Amazonas, Brazil. 6. *S. nitida.*

8. Leaves chartaceous dull. ♂ flowers essentially destitute of a perianth, i.e., calyx reduced to a small scale. Filaments long. Stigmas elongate, erect or slightly incurved. Capsule 1.5 cm high, 1.5 cm wide. Tingo Maria, Peru. 7. *S. skutchiana.*

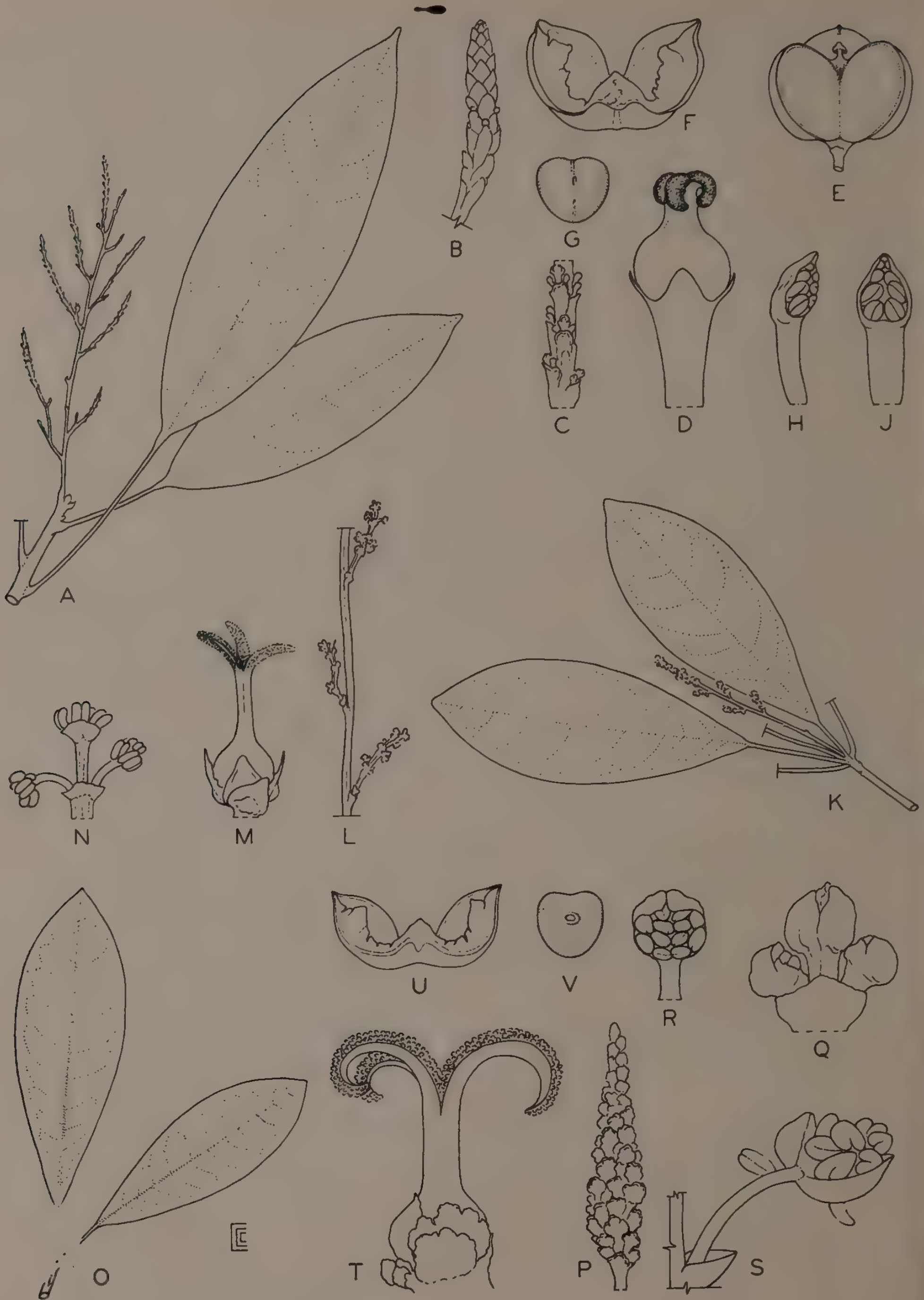

FIG. 27. *Senefeldera macrophylla* (A, C, D, *Ducke 49;* B, H, J, *Ducke 18002;* E, *Krukoff 7171;* F, G, *Smith 2960*). A, twig with inflorescence, × 0.5. B, inflorescence, × 2. C, inflorescence, × 4. D, ♀ flower, × 5. E, capsule, × 1. F, valve of capsule, × 1. G, seed, × 1. H, lateral view of ♂ flower, × 15. J, abaxial view of ♂ flower, × 15. *Senefeldera nitida* (K–N, *Croizat 8653*). K, twig, × 0.25. L, part of inflorescence, × 10. M, ♀ flower, × 2.5. N, ♂ cymule of 3

2. Seeds sharply apiculate at center of dorsal side. Flowers unknown. Base of upper side of midrib eglandular. Villavicencio, Colombia. 8. *S. karsteniana.*

1. Stamens more than 15. ♂ flowers inclined, i.e., attached sidewise to the stout pedicel. Leaves large elliptic, coriaceous, shiny, to 35 cm long, 15 cm wide, eglandular. ♀ flowers and fruits unknown. Leticia, Amazonia, Colombia. 9. *S. contracta.*

1. **Senefeldera multiflora** Martius, Flora 24, Beibl. **2**: 29. 1841.

Type. BRAZIL. Rio de Janeiro, *Martius 465.*
Distribution. Southeastern Brazil.

2. **Senefeldera triandra** Pax et K. Hoffm., Pflanzenr. IV. 147. xiv (Heft. 68). Additamentum **6**: 55. 1919.

Type. BRAZIL. Amazonas, Seringal S. Francis, Rio Acre, *Ule 9547.*
Distribution. Known only from the type locality.

3. **Senefeldera testiculata** Pittier, Contribuciones Fl. Venezolana **2** (3 decad.): 31. 1923.

Type. VENEZUELA. Zulia, *Pittier 10910.*
Distribution. Southwest of Lake Maracaibo, Venezuela.

4. **Senefeldera macrophylla** Ducke, Arch. Jard. Bot. Rio de Janeiro **4**: 113. 1925. Fig. 27 A–J.

Type. BRAZIL. Pará, syntype ♂ fl., *Ducke 18002;* syntype fr., *Ducke 18001.*
Distribution. Amazon Valley of Brazil, Iquitos, Peru, Akarai Mountains, British Guiana.

5. **Senefeldera inclinata** Müll. Arg. in Martius, Fl. Bras. 11, **2**: 530. 1874. Fig. 27 O–V.

S. multiflora var. ε *acutifolia* Müll. Arg. in DC. Prodr. 15, **2**: 1154. 1866, pro parte quoad specimine Spruceano pertinens.

Type. BRAZIL. Alto Amazonas, ad flumina Casiquiari, Vasiva et Pacimoni, 1853–4, *Spruce 3431* (K, BM, NY, GH, photo of B specimen in NY).

Vernacular Name. Palo de Perro de Agua (Tama-Tama).

Distribution. This tree, 10–12 m high, is known from two limited areas, one on the Upper Orinoco (Casiquiare, Yavita and Tama-Tama areas of Venezuela), the other Leticia in Amazonian Colombia. VENEZUELA. Amazonas: Yavita, Rio Temik, alt. 127 m, 3 Apr 1942, *Williams 14956* (♂ ♀ fl. fr. US, A, F); secondary jungle of Tama-Tama, alt. 121 m, 4 May 1942, *Williams 15144* (fr. F), 12 June 1942, *Williams 15840* (fr. F, US). COLOMBIA. Amazonas: Leticia, 16 Aug 1946, *Schultes & Black 46–4* (♂ ♀ fl. US).

Although both flowers and fruit of this species are known, they come from different collections and their correlation is not always certain. There is only one complete collection (*Williams 14958*) with both ♂ and ♀ flowers and fruit and seed available. The type consists of a fruiting specimen and a very poor

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flowers, × 5. *Senefeldera inclinata* (O–P, *Spruce 3431;* Q–T, *Williams 14958;* U–V, *Spruce 3431*). O, twig, × 4. P, inflorescence, × 4. Q, ♂ cymule of 3 flowers, × 10. R, ♂ flower, abaxial view, × 10. S, ♂ flower, lateral view, × 10. T, ♀ flower, × 4. U, valve of fruit, × 1. V, seed, × 1.

juvenile inflorescence with ♂ flowers. The Tama-Tama collection has only fruit, the Leticia collection only ♂ flowers but no well developed fruit. Under these circumstances some doubt remains as to the correctness of circumscription of the species.

All four collections agree in vegetative aspects. The leaves are lanceolate, coriaceous, eglandulate at the base of both surfaces. The blade varies from 14 to 23 cm in length, and 4.5 to 8.5 in width. Petiole is long, 2–6 cm. All are shiny except the latter.

Müller Arg. originally (1866) confused this species with his *S. multiflora* var. *acutifolia,* but later (1874) recognized it as distinct.

6. **Senefeldera nitida** Croizat, Jour. Wash. Acad. **33**: 18. 1943. Fig. 27 K–N.

Type. BRAZIL. Amazonas, Municipality of Humayata, *Krukoff 7126.*
Distribution. Southern part of Amazon Valley, Brazil.

7. **Senefeldera skutchiana** Croizat, Jour. Wash. Acad. **33**: 18. 1943.

Type. PERU. Huanuco, Tingo Maria, *Skutch 4967.*
Distribution. Known only from the type locality.

8. **Senefeldera karsteniana** Pax et K. Hoffm., Pflanzenr. IV. 147. V. (Heft. 52). 25. 1912.

Type. COLOMBIA. Villavicencio, *Karsten s.n.*
Distribution. Known only from the type locality.

9. **Senefeldera contracta** Schultes, Bot. Mus. Leafl. Harv. Univ. **16**: 72. 1953.

Type. COLOMBIA. Amazonas, Near Leticia, *George A. Black & Richard Evans Schultes 46–36.*

Distribution. Known only from the type locality.

Senefelderopsis Steyermark, Bot. Mus. Leafl. **15**: 45. 1951.

Small trees or bushes with copious latex. Lamina (with the exception of *S. venamoensis*) biglandular at the base. Young branches stout, fleshy.

In contrast with *Senefeldera,* the cymules, arranged in spikes, are many-flowered (5–10), the number of stamens 2 (rarely 4), glands on bracts subtending the cymules are conspicuous, often larger than the bracts, the ♂ calyx is well developed and consists of three highly imbricate sepals completely covering the androecium before anthesis. The capsule (known only in *S. chiribiquetensis*) is elongate-ovoid, subcylindrical, longer than wide with a black, rough, dull surface and a sharp beak. The seeds are ovoid-elongate or cylindric, with a white caruncule. Staminate flowers (known only in *S. croizatii*) are similar to those of *Senefeldera.*

Type species: *Senefelderopsis croizatii* Steyermark.

This genus differs greatly from *Senefeldera* in both vegetative and sexual characters. Unfortunately, none of the three species is sufficiently represented by collected material to permit circumscription of the genus, which now rests on characters of the ♂ flowers and vegetative parts.

Certainly *Senefelderopsis* is not closely related to *Senefeldera.* Otherwise, what its relationship is to *Sapium, Gymnanthes* and *Actinostemon,* remains to be established.

Key to the Species of *Senefelderopsis*

1. Leaves biglandular at base.
  2. ♂ flowers short-pedicelled or sessile, 7–10 per cymule. Glands almost as large as the bracts. Spikes dense, to 6 cm long. Leaves cuneate at base, silvery white below. 1. *S. croizatii.*
  2. ♂ flowers distinctly pedicelled, 3–5 per cymule.
    3. Leaves obovate, cuneate at base, rounded at apex, grayish silvery below. Spikes stout, 5–8 cm long. Bracteal glands prominent, broad elliptic or disk-like. Cerro Sipapo, Amazonas, Venezuela. 2. *S. sipapoensis.*
    3. Leaves lanceolate or elliptic-lanceolate, subrotundate at base, sharp acute at apex, yellowish-brown below. Spikes slender, 7–12 cm long. Bracteal glands narrow cylindric. 3. *S. chiribiquetensis.*
1. Leaves eglandular at base. Flowers unknown. Cerro Venamo, Gran Sabana, Bolivar, Venezuela. 4. *S. venamoensis.*

1. **Senefelderopsis croizatii** Steyermark, Bot. Mus. Leafl. **15**: 45, *pl. 16,* 1951.

Type. Southeastern base of Carrao-tepui, alt. 1460–1615 m, 4–5 Dec 1944, *Julian A. Steyermark 60849* (holotype F, ♂ ♀ fl., no fruit).
Distribution. Known only by the type specimen.

2. **Senefelderopsis sipapoensis** Jablonski, sp. nov.

Lamina obovata, apice rotundato basi cuneata, biglandulosa, in sicco subtus albo-grisea. Spica multicymulosa, cymuli 36–40 vel plures, 5–8 cm longitudine. Cymuli pauciflori, flores 4 pro cymulo. Stamina vulgo 2 rariter 4. Glandulae bractearum cymulos fultantiarum elliptico-discoideae, magnitudo bractearum aequantiae vel paulisper eas superantiae. Flores ♀ fructusque ignoti.

Differt a *S. chiribiquetensi,* cui similis, foliorum forma, staminarum numero, magnitudine glandularum cymuligerum.

Type. VENEZUELA. Amazonas: Cerro Sipapo, Camp savanna, tree 15 m, flowers green, latex white, 6 Dec 1948, *Maguire & Politi 27544* (NY).
Distribution. Known only from the type locality.

3. **Senefelderopsis chiribiquetensis** (Schultes & Croizat) Steyermark, Bot. Mus. Leafl. **15**: 47. 1915.

Senefeldera chiribiquetensis Schultes & Croizat, Caldasia 3: 122, *fig.* 1944.

Type. Upper Apaporis Basin-Rio Macaya, Sierra Chiribiqueta (or Cerro Comejen), alt. 1700–2100 ft, 15–16 May 1943, Vaupes, Colombia, *R. E. Schultes 5456* (holotype AMES, not seen, isotype GH, photo F, ♂ flowers and fruit, no ♀ fl.). Paratypes. Macaya-Ajaju River confluence, Mt. Chiribiquete, quartzite base, 15–16 May 1943, *R. E. Schultes 5464* (NY, 2 GH), *5466* (GH), *5484* (GH, US); 24 Jul 1943, *5623* (NY, US, 2 GH, photo F); Jan 1944, *5736a* (GH, 2 US).

Distribution. A bush 4–9 ft high or tree to 8 m high, yielding a copious white latex, known from the sandstone hills of Vaupés, Colombia, and the Upper Orinoco region of Amazonas, Venezuela. COLOMBIA. Vaupés: Estrecho de Macuje, 1–6 Jun 1943, *Schultes 5535* (F, GH); Ajaju River, Cerro la Campana, 4–6 Jun 1943, *Schultes 5551* (F); Riberas del Rio Mirida (long. 69° 45′ W), sitio "Raudal Alto" o Mariapiri, margen derecha, alt. 250 m (Cerro Varador), 3 Feb 1953, *Fernandez 2072, 2079* (F, US); Rio Gaviare, San Jose del Gaviare, terrenos graniticos, sabana alt. 270 m, 12 Nov 1939, *Cuatrecasas 7682* (US), fruit only; Cerro Chiribiquete, a un lado del Rio Macaya, terreno muy pedregoso, 17 Jan 1944, *Gutierrez & Schultes 681* (NY), fruit only. VENEZUELA. Amazonas:

Cerro Moriche, alt. 3000–4500 ft, 15 Jan 1951, *Maguire, Cowan, Wurdack 30941, 30964* (NY, fruit only); 16 Jan 1951, *30968* (NY); right branch Cano Yutaje, dry rocky slope, alt. 1400 m, 9 Feb 1953, *Maguire & Maguire 35113* (NY); northwest ridge Cano Yutaje, alt. 1400 m, 11 Feb 1953, *Maguire & Maguire 35157* (NY).

There is a conspicuous absence of ♀ flowers in the entire collection of this species, so the distinction from other *Senefelderopsis* must be based upon vegetative characters and on those of the ♂ flowers.

The leaves are lanceolate-elliptic or lanceolate, acute at the tip and subrounded at the base, 9–15 cm long, 4–8 cm wide, pale yellow below. The ♂ spikes are slender, 7–14 cm long. The bracteal glands of cymules are narrow-cylindric. The number of flowers per cymule is 3 (rarely 5). The number of stamens per flower is 3–4. Flowers are distinctly pedicelled, the pedicels being at least twice as long as the flowers and articulate. Capsules are 1.6–2.2 cm long, 1.4–1.5 cm thick, subcylindric, cordate at the base, sharply beaked at the tip, rough, black on the surface. Pericarp is 1.0–1.2 mm thick, ligneous. Seeds are black, shiny, ovoid cylindric, 6–8 mm long, 4–5 mm thick, with a white, 1.2 mm long caruncule at the top.

4. **Senefelderopsis venamoensis** Jablonski, sp. nov.

Lamina foliorum obovata vel elliptica, subtus glauca, 11–14 cm longitudine, 6–7 cm latitudine, basi cuneata, apice subrotundato vel subacuto. Fructus more *S. chiribiquitensi* subcylindrica atra, opaca, apice rostrato. Pericarpium lignosum durum, 2 mm crassitudine. Semina globosa, subnitidula, ecarunculata. Flores ignoti.

Type. VENEZUELA. Bolivar: northwest slopes between road campamento 125 and beginning of dwarf forest above sandstone bluffs, above waterfall, Cerro Venamo, alt. 1100–1300 m, 14 Apr 1960, *Julian A. Steyermark & Sven Nilsson 726* (NY).

Distribution. Known only from the type.

Celianella Jablonski, gen. nov.

E tribu *Phyllanthearum* verisimiliter dioicus, apetalus; sepalis ♂ distincte quincuncialiter imbricatis, disco centrali, disci glandulis intra stamina confluentibus, lobis alternisepalis. Stamina 5, libera, episepala, antheris bilocularibus, introrsis pendulis. Ovarii rudimentum nullum. Calyx comparate magnus, sepalis 5 sub fructu accrescentibus, disco hypogyno annulari. Ovarium triloculare, stylis 3, ad basim connatis, ad apicem bifidis. Ovula in quoque loculo gemina in angulo centrali sub obturatore unico inserta ex raphide centrali pendula, carunculis albis notata. Fructus capsularis more familiae simul loculicidaliter et septicidaliter dehiscens, columellam centralem persistem reliquens. Semina elongata fusiformia, carunculo minuto. Cotyledones plani foliacei quam radicula multo latiores, albumine carnoso copioso. Albumen quatuor partes quintas seminis implerens, parte quinta reliqua ab embryone occupata.

Genus monotypicum evidenter ab omnibus generibus tribus Phyllanthearum distinctum, calyce fructifero valde aucto, disco ♂ centrali, cymulis ♂ pedicellatis, foliis semisucculentibus.

Nomen dedi in honorem Celiae Maguire in expeditionbus atque collectionibus botanicis Guayanensibus optime meritae.

Type species. *Celianella montana* Jablonski.

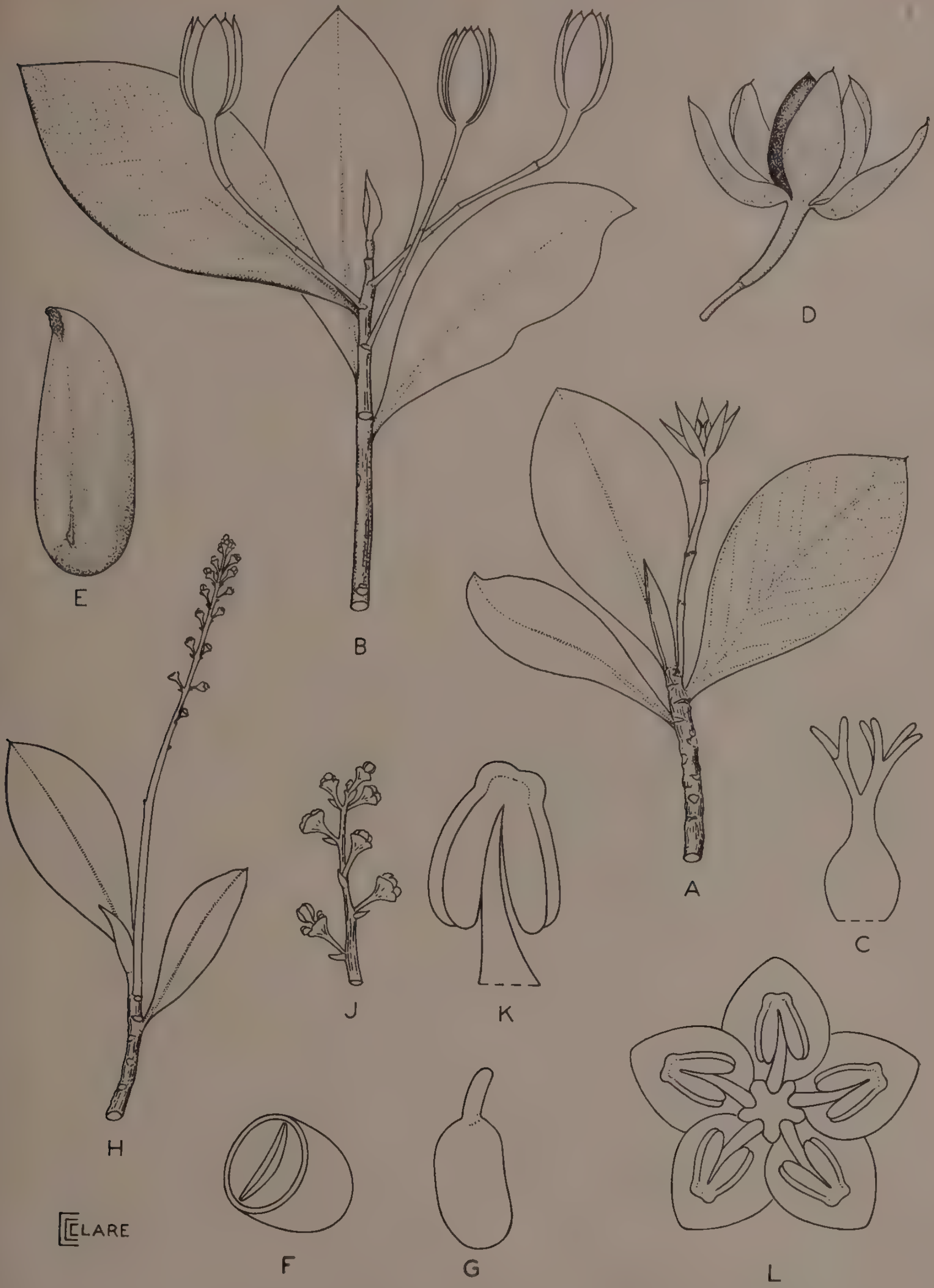

FIG. 28. *Celianella montana* (A–G, *Maguire & Maguire 35070*; H–L, *35071*). A, twig with ♀ flower, × 0.75. B, twig with fruits, × 0.75. C, pistil, × 3. D, fruit with accrescent calyx, × 1. E, seed, × 5. F, seed, cross section, × 5. G, embryo, × 5. H, twig with ♂ inflorescence, × 0.75. J, ♂ inflorescence part, × 1.5. K, stamen, × 20. L, ♂ flower, × 10.

1. **Celianella montana** Jablonski, sp. nov. Fig. 28.

Frutices 1–5-metrales, ramulis griseis sulcatis. Foliis subsucculentibus, integerrimis, sessilibus penninerviis, obovatis vel ellipticis, ad basim longe cuneatis, viridibus vel rubicundis. Nerva media prominenter crassiuscula, nervis lateralibus subrecte densiuscule multis jugis (15–17), infimis decurrentibus. Stipulae nisi juveniles non visae angustissime lanceolatae acuminatae, 1–2 cm longae, 2–3 cm latae, cito caducae, cicatrices prominentes reliquentes.

Inflorescentiae ♂ racemosae, glomerulos pedunculatos in axillis bracearum fere minutarum gerentes. Glomeruli e quadri- ad multifloros, pedunculis 4–6 mm longis. Bracteolae intracymulosae membranaceae, lanceolatae acutae. Flores ♂ aperti 3 mm diametientes, sepalis 5, orbicularibus, staminibus 5. Discus centralis pulvinulatus saepe irregulariter quinque lobatus, filamentis inter lobos insertis.

Inflorescentiae ♀ subterminales 1–3-florae, vel flores in apice ramulorum solitares. Flores ♀ apetali, sepalis 10–13 mm longis. Ovarium 4 mm altum, stylo stigmatibus comprehensis 5 mm longo. Ovula 1.2 mm longa.

Pedicelli fructiferi 3-nodosi, nodis 1–5 cm longis, sub fructu incrassatis. Fructus unicus in apice pedicelli, vel in racemis 3–4-floris. Sepala accrescentia, ad 1.8–2.7 cm longitudine et ad 0.4–1.1 cm latitudine, reticulato-nervosa, lanceolata vel elliptica ad apicem obtusiuscula, mucronata, magento-purpurea.

Capsula omnia in specimina visa in valvas tortas delapsa, valvis 1.3–1.6 cm longis, interne duas appendiculas gerentes. Post dehiscentiam valvarum columella trigona ad apicem incrassata persistens.

Semina 6.5–7 mm longa, 2.5–3 mm crassa. Embryo centralis, recta, 5 mm longa, 2.2 mm lata. Radicula 1.5 mm longa cylindrica, supera.

Distribution. VENEZUELA. Amazonas: Camp Yutajé, thickets and low bush 1300 m alt., 8 Feb 1953. Shrub 0.5–5 m high, leaves coriaceous, subsucculent, reddish margin, flowers greenish yellow, sepals in fruit, red, styles bifid, *Bassett Maguire & Celia Maguire 35070,* fruits only (holotype NY).

Paratypes. Same locality, *Maguire & Maguire 35071,* ♂ flowers (NY); middle section, main branch, left hand fork Cano Yutajé, alt. 1300–1400 m, 15 Feb 1953, *Maguire & Maguire 35072,* ♀ flowers (NY).

RUBIACEAE[29]

Tribe Condamineae

Chimarrhis Jacq. Stirp. Am. 61. 1763.

Pseudochimarrhis Ducke, Archiv. Jard. Bot. Rio Janeiro 3: 255. 1922; 4: 177. *pl. 23.* 1925.

Type species. *C. cymosa* Jacq.

Key to the Species of *Chimarrhis* in South America and the West Indies

1. Disk on summit of ovary pubescent.
  2. Style pubescent.
    3. Lower surface of leaf-blade completely glabrous.
      4. Leaf-blades acute at base; fruiting capsule glabrous without, 9 mm long. 1. *C. barbata.*
      4. Leaf-blades broadly rounded to subcordate at base; fruiting capsule densely tomentulose without, 5 mm long. 2. *C. brevipes.*

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[29] By Julian A. Steyermark, Instituto Botanico, MAC, Caracas, Venezuela.

3. Lower surface of leaf-blades puberulent on lateral nerves and portion of midrib and/or leaf-surface. 3. *C. turbinata.*

2. Style glabrous.

5. Hypanthium and calyx glabrous without; stipules minutely sericeous without. 4. *C. williamsii.*

5. Hypanthium and calyx pubescent without; stipules glabrous without. 5. *C. hookeri.*

1. Disk on summit of ovary glabrous.

6. Lower surface of leaf-blades completely glabrous and lacking barbate axils. 6. *C. glabriflora.*

6. Lower surface of leaf-blades or lateral nerves or midrib beneath pubescent, or at least with barbate axils at junction of lateral nerves and midrib.

7. Hypanthium and/or calyx densely pubescent without; capsule pubescent. 7. *C. bathysoides.*

7. Hypanthium and/or calyx glabrous without; capsule glabrous.

8. Axils of lateral nerves with midrib on lower side of leaf-blade not barbate; Panama. 8. *C. parviflora.*

8. Axils of lateral nerves with midrib on lower side of leaf-blades barbate; South America and West Indies.

9. Anthers 0.5–0.8 mm long; mature fruiting capsules 1.5–2 mm long, 1.5–2 mm broad. 9. *C. microcarpa.*

9. Anthers 1–2 mm long; mature fruiting capsules 2–4.5 mm long, 2–3.5 mm broad.

10. Inflorescence above the lowest primary branches of peduncle 6–11.5 cm high, 9–17 cm broad; anthers 0.8–1 mm long, more or less rounded at summit; summit of capsule protruding beyond the calyx limb. 10. *C. cymosa.*

10. Inflorescence above the lowest primary branches of peduncle 3–6 cm high, 4–7 cm broad; anthers 1.5–2 mm long, more or less narrowed to apiculate at summit; summit of capsule not protruding beyond the calyx limb.

11. Capsule 4–5 mm long; lowest primary axes of inflorescence 1–4.5 cm long; calyx and hypanthium (combined) in full anthesis mainly 2.5–3.5 mm long; leaf-blades 12–23 cm long, 5–8 cm broad; lateral nerves of leaf-blades 9–11 on each side. 11. *C. jamaicensis.*

11. Capsule 2–3.5 mm long; lowest primary axes of inflorescence 1–2.2 cm long; calyx and hypanthium (combined) in full anthesis mainly 1.8–2 mm long; leaf-blades 5.5–13 cm long, 2–6 cm broad; lateral nerves of leaf-blades 7–8 on each side. 12. *C. cubensis.*

1. **Chimarrhis barbata** (Ducke) Bremek. in Rec. Trav. Bot. Neerl. **31**: 260. 1934, in obs.

Pseudochimarrhis barbata Ducke, Archiv. Jard. Bot. Rio Janeiro **4**: 178. 1925, type: Inter Boim et Serra de Humayta, in silvis primariis non inundatis regione fluminis Tapajoz, Brazil, 8–4–1924, *J. G. Kuhlmann 17384* (R).

Distribution. Known only from Amazonian Brazil.

As stated by Bremekamp (Trav. Bot. Neerl. **31**: 260), the characters upon which Ducke founded his genus *Pseudochimarrhis* differ in no significant details to justify separation of the genus from *Chimarrhis*. Rizzini (Rev. Bras. Biol. **7**(2): 275. 1947), likewise, confirms Bremekamp's views.

2. **Chimarrhis brevipes** Steyermark, sp. nov.

Arbuscula, stipulis late triangulari-ovatis acutis vel acuminatis 8–9 mm longis basi 7–8 mm latis glabris; foliis petiolatis, petiolis 4–10 mm longis glabris; laminis late suborbiculari-ovalibus vel late obovato-ovalibus apice rotundatis basi subcordatis vel rotundatis, 13–25 cm longis 11–17 cm latis utrinque glabris; nervis lateralibus utroque latere 6–8 subtus prominentibus, nervis tertiariis subtus cum nervis lateralibus laxe transverseque junctis; floribus haud visis; inflorescentiis fructigeris 11–15 cm longis, pedunculo incluso; pedunculo 6–9 cm longo inferne glabrato vel parce puberulenti, superne subtomentello, axibus primariis tribus 2–2.5 cm longis dense puberulentibus; capsulis confertis glomerulatis subsessilibus ad 1 mm pedicellatis turbinato-ovatis apice late truncatis basi angustatis 5 mm longis 3.5–4 mm latis tomentellis supra calycem haud protrudentibus; disco tomentuloso supra calycem persistentem haud protrudenti; calyce in fructu persistenti breviter repando; seminibus suborbicularibus vel rhomboideis ad subtriangularibus 1–1.8 mm longis irregulariter erosis vel lobatis alatis, margine alato 0.1–0.5 mm lato, corpusculo ferrugineo suborbiculari 0.7–1 mm lato manifeste foveolato-reticulato.

Type. Small tree; forest near Base Camp, Cerro Sipapo, Amazonas, Venezuela, at alt. 125 m, 25 Dec 1948, *Bassett Maguire & Louis Politi 27971* (holotype NY).

This species is related to *C. turbinata* DC. of Brazil, French Guiana, and Suriname, from which it differs in the leaf-blades completely glabrous beneath, glabrous stipules, fewer lateral nerves of the leaf-blades, larger broader leaf-blades more rounded at both ends, and relatively short petioles. From *C. barbata* it differs in the tomentulose shorter fruiting capsules and leaf-blades rounded to subcordate at base.

3. **Chimarrhis turbinata** DC. Prod. **4**: 404. 1830.

Pseudochimarrhis turbinata (DC.) Ducke, Archiv. Jard. Bot. Rio Janeiro 3: 255. 1922.
Elaeagia brasiliensis Standl. in Gleason & A. C. Smith, Bull. Torrey Bot. Club **60**: 395. 1933, type: Boa Vista, Fordlandia, Tapajos river region, Pará, Brazil, Sep 1931, *B. A. Krukoff 1018* (NY).
Chimarrhis duckei Rizz. Rev. Bras. Biol. 7: 277. 1947.

Type. In Cayenna (French Guiana), *Patris.*

Distribution. Suriname, French Guiana, and Amazonian Brazil (Pará, Amapá).

I have not been able to discern any differences between specimens cited by Ducke (*15457, 15480, 9425,* and *9713* in Archiv. Jard. Bot. Rio Janeiro **3**: 255. 1922) and those later cited as the same species (Archiv. Bot. Rio Janeiro **4**: 178. 1925), but the latter reference treated by Rizzini is a different species, *C. duckei.*

4. **Chimarrhis williamsii** Standl. Field Mus. Bot. Ser. **8**: 162. 1930.

Type. Lower Río Nanay, Dept. Loreto, Peru, 23 May 1929, *Llewelyn Williams 409* (F).

Distribution. Amazonian Peru, at alt. 160 m or lower.

5. **Chimarrhis hookeri** K. Schum. in Mart. Fl. Bras. **6**(6): 259. 1889.

Type. Prope Tarapoto, Peru, 1855–6, *R. Spruce 4930* (isotype NY).

Distribution. Amazonian Peru.

This species is somewhat similar to *C. cymosa,* but has a truncate to subtruncate border of the calyx which is glabrous or nearly so and the disk on the summit of the ovary in *C. cymosa* is glabrous. The photo of the type specimen from K shows fragments of two inflorescence branches which appear to be in young anthesis with buds not fully opened and with two detached leaves. An examination of the isotype specimen at NY shows the length of the calyx and hypanthium in pre-anthesis stage to be only 2 mm long. Schumann's description of the calyx and hypanthium as "8 mm" long is probably a typographical error.

6. **Chimarrhis glabriflora** Ducke, Bot. Tecn. Inst. Agron. Norte, Pará, **4**: 26. 1945.

Type. Ad ostium fluminis Javary, Esperanca, Amazonas, Brazil, 15 Mar 1944, *A. Ducke 1618* (RIO, NY).

Distribution. Amazonian Brazil and Peru. PERU. Gamitanacocha, Río Mazán, Dept. Loreto, 1 Mar 1935, *Schunke 331*. The Peru collection was identified by Standley as *C. williamsii* Standl., but is obviously not that species, as the stipules and lower leaf surfaces are entirely glabrous.

Chimarrhis glabriflora differs from *C. turbinata* and *C. barbata,* as well as *C. hookeri,* in the glabrous disk.

7. **Chimarrhis bathysoides** Steyermark, sp. nov. Fig. 29.

Arbor 7-metralis, stipulis caducis terminalibus lanceolato-oblongis 12–13 mm longis extus dense strigosis; foliis petiolatis, petiolis 6–13 mm longis glabris; laminis elliptico-obovatis apice abrupte acuminatis basi acutis vel subobtusis, 14–21.5 cm longis 8–15 cm latis utrinque glabris, subtus in axillis nervorum minute barbellatis, nervis tertiariis prominentibus; nervis lateralibus utroque latere 7–8; inflorescentia paniculato-cymosa 22 cm longa 25 cm lata 5 cm longe pedunculata divaricate ramosa, ramis dense puberulenti-tomentosis densifloris; floribus sessilibus vel subsessilibus 2- vel 3-fasciculatis per axes ultimas insidentibus; calyce hypanthioque subcylindrico 3 mm longo, hypanthio 2 mm longo extus minute adpresso-puberulenti; calyce extus puberulenti, tubo ca. 0.7–0.8 mm longo usque ad hypanthium manifeste constricto 5-lobato, lobis brevibus late rotundatis 0.2 mm altis 0.5 mm latis; corolla subcylindrica 2.5 mm longa, tubo 1.6–1.8 mm longo 0.8–0.9 mm lato vel fauce 1.2–1.5 mm lato, extus glabro intus fauce dense villoso ceterum glabro, lobis suborbicularibus vel late rhomboideo-oblongis obtusis vel rotundatis 0.7–1 mm longis 0.7–0.8 mm latis utrinque glabris; antheris late oblongis 0.5 mm longis; filamentis 2 mm longis exsertis glabris basi dense villosa excepta; stylo clavato exserto 3 mm longo glabro, stigmatibus oblongis apice rotundatis 1 mm longis.

Type. Tree 7 m high, flowers white; forest along trail near Base Camp, Cerro Sipapo, Amazonas, Venezuela, at alt. 125 m, 25 Jan 1949, *Bassett Maguire & Louis Politi 28626* (holotype NY).

The holotype is in full anthesis. An examination of the youngest flowers which have not expanded shows the aestivation too far advanced to judge whether the corolla-lobes are valvate. However, a careful microscopic dissection reveals the youngest flowers (before the stamens have become exserted) with the corolla-lobes separated but apparently of valvate origin. For this reason, the species is placed in the genus *Chimarrhis.* Although the leaves and inflorescence habit resemble the genus *Bathysa,* that genus generally has persistent interpetiolar stipules remaining attached below the apex, imbricate corolla-lobes, usually pubescent style, and usually subalate seeds. The newly described *C. bathysoides* also resembles *Sickingia,* but that genus has imbricate aestivation of the corolla-lobes, loculicidally dehiscent larger capsules with winged seeds, and usually caducous stipules.

Among the species of the genus *Chimarrhis,* the new species is outstanding in the very short corolla-lobe with respect to the length of the corolla-tube (in this respect resembling *Parachimarrhis breviloba* Ducke), in the very broad, loosely branched inflorescence, and in the conspicuously transverse tertiary venation connecting the lateral nerves. From *Parachimarrhis breviloba,* it may be sepa-

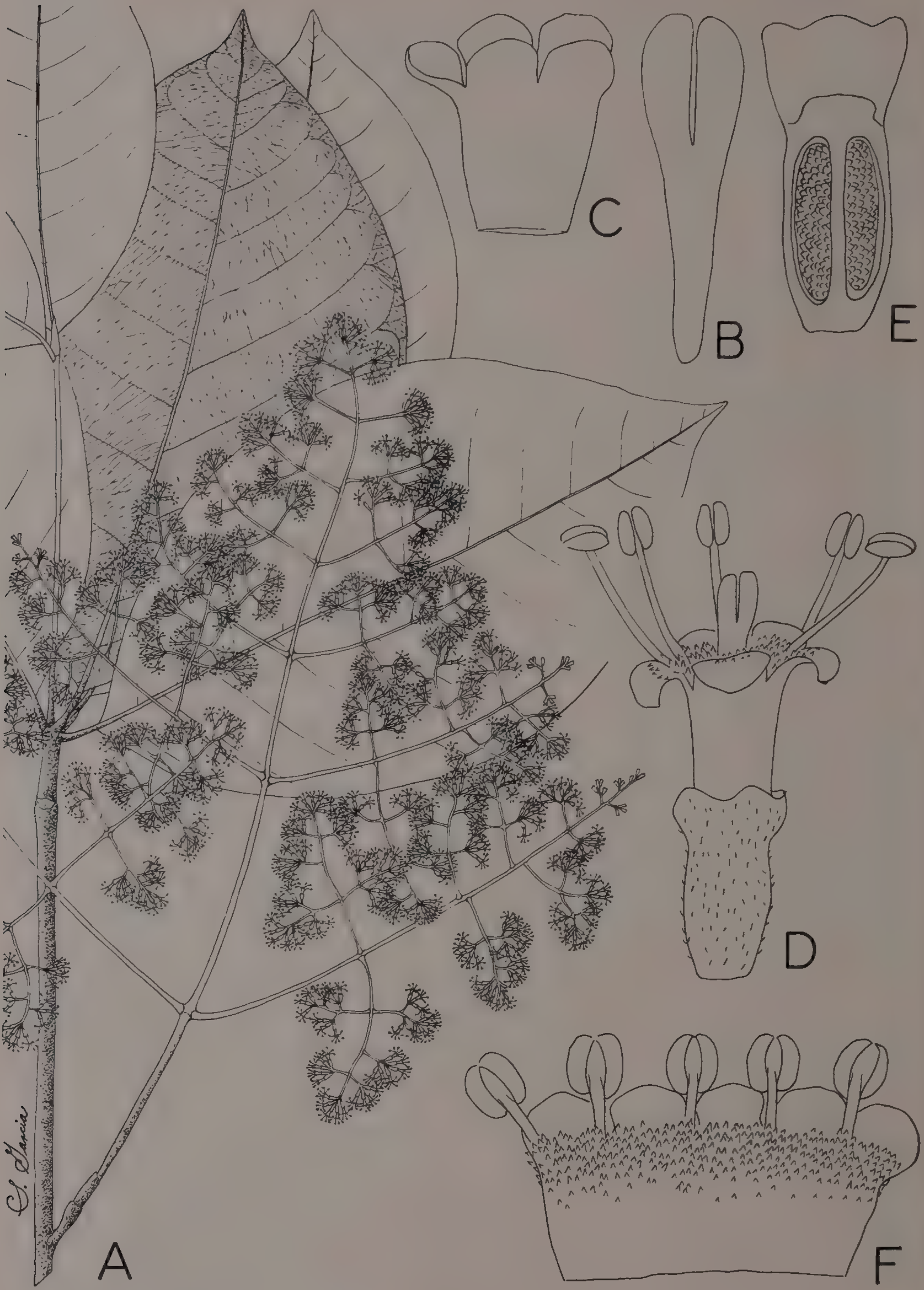

FIG. 29. A–F, *Chimarrhis bathysoides.* A, habit of flowering branch, × 1/2. B, corolla, in bud, × 10. C, corolla, × 20. D, flower, in natural position, × 7. E, vertical section through calyx and hypanthium, × 10. F, corolla, immature stage, interior view, × 10.

rated by the septicidal dehiscence of the capsule, prominently pubescent, persistent terminal stipules, larger leaf-blades, larger inflorescences on longer peduncles, larger calyx with rounded lobes, smaller corolla, and smaller seeds. From *Chimarrhis turbinata* it differs in the glabrous style and disk, smaller and narrower corollas, and more lobate calyx.

8. Chimarrhis parviflora Standl. Trop. Woods **11**: 26. 1927.

Type. Changuinola Valley, 1927, *G. P. Cooper & G. M. Slater 120* (NY).

Distribution. Panama and Costa Rica. A collection from Villa Quesada, Canton San Carlos, Prov. Alajuela, Costa Rica, *Austin Smith 1890,* is referable to this species.

9. Chimarrhis microcarpa Standl. Bull. Torrey Bot. Club **53**: 471. 1926.

Key to the Varieties of *Chimarrhis microcarpa*

1. Inflorescence above the lowest primary branches of peduncle 2.5–4.5 cm high, 3.5–6.5 cm broad; ultimate inflorescences 1.5–3 cm high, 2.5–3.5 cm broad; corolla 2.8–5.5 mm long. var. *microcarpa.*
1. Inflorescence above the lowest primary branches of peduncle 6–11 cm high, 10–17 cm broad; ultimate inflorescences 3–5 cm high, 5–6 cm broad; corolla 2–2.5 mm long. var. *speciosa.*

9a. Chimarrhis microcarpa Standl. var. **microcarpa.**

Type. Maraval, Trinidad, 1904, *I. Dannouse 6946* (NY).

Chimarrhis longistipulata Bremek. Rec. Trav. Bot. Neerl. 31: 260. 1934, type: Kabalebo River prope Avanavero Falls, Suriname, *A. Pulle 379* (U).

Distribution. Trinidad, eastern Venezuela, British Guiana and Suriname.

Standley described the leaves of the type specimen as glabrous, but an examination of them under binocular microscope reveals barbate axils on the lower leaf surface. The var. *microcarpa* applies to the common variation, originally described from Trinidad, having small capsules 2 mm long and 1.5–2 mm broad, and relatively small compact inflorescences and infructescences. The Surinam *C. longistipulata* Bremek., based on small-fruited trees with long glabrous stipules can be matched by similar specimens of var. *microcarpa* having short capsules, stipules elongated to 4 cm or more, and barbate leaf axils.

9b. Chimarrhis microcarpa var. **speciosa** Steyermark, var. nov.

A var. *microcarpa* differt corollis brevioribus 2–2.5 mm longis et ramis inflorescentiarum longioribus, inflorescentiis supra ramos primarios 6–11 cm altis 10–17 cm latis, inflorescentiis ultimis 3–5 cm altis 5–6 cm latis.

Type. Arbol de 15–20 m, de flores color cremosos, Rancho Grande, Venezuela, 18 Sep 1951, *T. Garcia 147* (holotype VEN). Paratypes. VENEZUELA. Aguacatal, at alt. 1000 m, *Jahn 1339* (NY); Estado Aragua: cloud forests of Rancho Grande, north side, at alt. 1100 m, *Pittier 14138, 15275* (VEN); south slope, Rancho Grande, *Pittier 13854* (NY, VEN); selvas humedas de Rancho Grande, *Lasser 2264* (VEN); steep wet forested slopes, Parque Nacional Henry Pittier, between trail up Periquito and Fila de Periquito, at alt. 1300–1400 m, *Steyermark 89885* (NY, VEN).

The var. *speciosa* is thus far known only from the central portion of the coastal cordillera of Venezuela, and is separated from var. *microcarpa* by having showier, larger inflorescences on more elongated primary axes of the peduncle and smaller corollas.

Some intermediate specimens exist in Venezuela in which the peduncles attain 7–15 cm in length and the inflorescences may be 10 cm broad and 6.5-7 cm high above the secondary lateral axes. These specimens are represented by *Steyermark 87104, 89961,* and *Bernardi 5943,* all from Parque Nacional de Guatopo, Estado Miranda.

10. **Chimarrhis cymosa** Jacq. Stirp. Am. 61. 1763.

Type from Martinique, West Indies.

Distribution. West Indies (Martinique, Guadeloupe, St. Vincent, Dominica).

Specimens from northern South America (Venezuela and the Guianas) and Trinidad have been previously confused with this species and are treated now as conspecific with the preceding species, *C. microcarpa* var. *microcarpa* and var. *speciosa.*

Urban (Symb. Ant. **1**: 410. 1899) correctly interpreted the holotype of *Chimarrhis cymosa* Jacq., type species of the genus, by describing the plant from Martinique as subsp. *genuina.* This accords with that element in the original description of Jacquin (Stirp. Am., p. 61) concerning the diameter of the inflorescence as ''semipedali.'' Urban's original splitting of *C. cymosa* into three subspecies (subsp. *genuina,* subsp. *jamaicensis,* and subsp. *microcarpa*) has been modified in the present treatment, where their status has been raised to specific rank. Measurable differences have been found in size and apex of anther, size of fruit, and size and branching of the inflorescence. In *C. cymosa* from Martinique, St. Vincent, Guadeloupe, and Dominica, the inflorescences are larger, the anthers are smaller with more rounded summits, and the apices of the capsules protrude from the calyx limb. In contrast, material from Cuba and Jamaica have longer, more pointed anthers, shorter, more contracted inflorescences, and the apex of the fruiting capsule does not protrude beyond the calyx limb. Also, sufficient differences appear to exist between the Cuban and Jamaican plants to warrant their being treated as specific taxa, especially differing in size of capsules and in length of calyx and hypanthium. In general, the leaf-blades of the Jamaican plants average larger than those of the Cuban ones, and those of the latter tend to develop greater pubescence on the lower leaf surface.

11. **Chimarrhis jamaicensis** (Urb.) Steyerm., stat. nov.

C. cymosa subsp. *jamaicensis* Urban, Symb. Ant. **1**: 411. 1899, type: Mount James, Jamaica, at alt. 330 m, 1871, *W. Harris 5810;* paratype, Silver Hill, Jamaica, *Harris 5828* (NY).

C. cymosa var. *jamaicensis* Standl. Field Mus. Bot. Ser. **11**: 192. 1936.

Distribution. Known only from Jamaica.

12. **Chimarrhis cubensis** Steyermark, nom. nov.

C. cymosa subsp. *microcarpa* Urban, Symb. Ant. **1**: 410. 1900, type: prope villam Monte Verde, Cuba orientali, Jan.–Jul., 1859, *C. Wright 1262* (G).

C. cymosa var. *microcarpa* (Urb.) Standl. Field Mus. Bot. Ser. **11**: 192. 1936.

Distribution. Known only from Cuba.

Because of the previously published *Chimarrhis microcarpa* Standl., based on Trinidad plants, the Cuban var. *microcarpa*, another taxon when raised to specific rank, must receive a new name.

All the Cuban material examined comes from the Sierra Maestra in the Province of Oriente.

Excluded Species

Chimarrhis (?) *dioica* Schum. & Krause in Engl. Jahrb. **40**: 312. 1908 = **Dioicodendron dioicum** (Schum. & Krause) Steyerm.

Chimarrhis venezuelensis Standl. & Steyerm., Fieldiana Bot. **28**: 570. *fig. 121.* 1953 = **Dioicodendron dioicum** (Schum. & Krause) Steyerm.

Chimarrhis decurrens Steyerm., Ceiba **3**: 18. 1952 = **Allenanthus erythrocarpus** Standl.

Chimarrhis goudotii Baill. Adansonia **12**: 307. 1879 = **Sickingia goudotii** (Baill.) Standl.

Chimarrhis paraensis Baill. Adansonia **12**: 308. 1879 = **Sickingia paraensis** (Baill.) K. Schum.

Chimarrhis pisoniaeformis Baill. ex K. Schum. in Mart. Fl. Bras. **6**(6): 226. 1889 = **Sickingia pisoniaeformis** (Baill.) K. Schum.

Chimarrhis ferruginea (Standl.) Standl. N. Am. Fl. **32**: 6. 1918 = **Rustia ferruginea** Standl.

Chimarrhis pittieri Standley, Field Mus. Bot. Ser. **8**: 53. 1930 = **Bathysa pittieri** (Standley) Steyermark, comb. nov.

Parachimarrhis Ducke, Archiv. Jard. Bot. Rio Janeiro **3**: 253. 1922.

Type species. *P. breviloba* Ducke.

1. **Parachimarrhis breviloba** Ducke, Archiv. Jard. Bot. Rio Janeiro **3**: 253. 1922.

Type. Prope cataractam Maranhaosinho, estrada dos cachoeiros inferiores perto de Maria Luize, Rio Tapajoz, Brazil, 6–12–1919, *Ducke 15687*, florifera (RIO); circa locum Francez, matta de terra firme, Rio Tapajoz, 19–12–1919, *Ducke 15400*, fructifer (RIO).

Distribution. Known only from the type collections of Brazil.

Through the courtesy of the Director of the Herbarium of the Jardim Botanico de Rio Janeiro, I have had the privilege of examining the type material. All except two items check with Ducke's description: 1) the ovary is 2-celled instead of 3–4-celled and 2) the calyx-lobes are ciliolate on the margins and not just apically as described originally. The valvate corolla-lobes indicate its relation with *Chimarrhis* and placement in the tribe *Condamineae.*

Parachimarrhis is a distinct genus, separated from *Chimarrhis* and *Elaeagia* as follows: in *Parachimarrhis* the capsule is loculicidally dehiscent, in *Chimarrhis* it is septicidally dehiscent; in *Parachimarrhis* there are 8–10 seeds in a capsule, and they are relatively large (2–2.5 mm long by 1.5 mm wide) and flattened, in *Chimarrhis* there are 20 or more seeds in a capsule, minute (1 mm or less long by 0.5 mm wide) and not flattened; in *Parachimarrhis* the filaments are pubescent except in the uppermost portion, in *Chimarrhis* they are bearded only at the base; in *Parachimarrhis* the corolla-lobes are very short, only 1/3 the length of the corolla-tube, in *Chimarrhis* they are usually equal to or longer than, but rarely shorter than the corolla-tube. The differences between *Parachimarrhis* and *Elaeagia* are as follows: in *Parachimarrhis* the stipules are small and caducous, in *Elaeagia* persistent at the tip and large; in *Parachimarrhis* the capsule has a conspicuous depression on each side, in *Elaeagia* it is more or less terete throughout; in *Parachimarrhis* the calyx-lobes are triangular and acute, in *Elaeagia* rounded, undulate, or not developed; in *Parachimarrhis* the seeds are relatively large (2–2.5 mm long by 1.5 mm wide), subflattened, and 8–10 in a capsule, in *Elaeagia* they are minute (1 mm or less long by 0.5 mm wide), not flattened, and 20 or more in a capsule; in *Parachimarrhis* the very short corolla-lobes are only 1/3 the length of the corolla-tube and erect, in *Elaeagia* they are 1/2 to equal to or longer than the corolla-tube and reflexed; in *Parachimarrhis* the corolla is pubescent within from the base up to the throat, in *Elaeagia* pubescent within only at the orifice; in *Parachimarrhis* the filaments are inserted at the base of the corolla-tube, in *Elaeagia* they are inserted at the throat.

Tribe Rondeletieae

Elaeagia Wedd. Monog. Cinch. 94. 1849.

Type species: *Elaeagia utilis* (Goudot) Wedd.

In the original description of the genus, Weddell described the aestivation of the corolla as imbricate. Actually, it is contorted, and all later authors have confirmed that the contorted aestivation is characteristic of the genus.

The genus is composed of several closely related species, except for *E. magniflora* Steyerm. of Venezuela. This species is known thus far only from flowering material and possesses characters—truncate large calyx, large corolla, and elongated pedicels—not found in the other species of the genus. The contorted corolla lobes, which it possesses, are characteristic of the rest of the genus.

A number of species, described from fruit only under the genus *Elaeagia*, prove to belong to members of the genera *Chimarrhis* and *Bathysa*, in which the dehiscence of the fruits is septicidal to distinguish them from the loculicidally dehiscent fruits of *Elaeagia*. Moreover, it has been found that the large leaves common to *Elaeagia*, *Chimarrhis*, and *Bathysa*, with a similar shape, have led to indiscriminate misidentifications with *Elaeagia* instead of *Chimarrhis* or *Bathysa*. A resinous exudate on the stipules is characteristic of the genus.

Key to the Species of *Elaeagia*

1. Lower surface of leaf-blade with tufts of barbate hairs along the midrib and lateral nerves. 12. *E. barbata.*
1. Without tufts of hairs so disposed.
  2. Pedicels 15–30 mm long in anthesis; corolla relatively large, 14 mm long. 15. *E. magniflora.*
  2. Pedicels sessile or up to 7 mm long in anthesis; corolla relatively small, 2–6 mm long.
    3. Calyx margin truncate or nearly so.
      4. Lower surface of leaf-blades papillate-asperulous and moderately appressed-puberulent; stems and inflorescence glabrous or glabrescent. 13. *E. asperula.*
      4. Lower surface of leaf-blades softly hirsutulous, not papillate-asperulous; stems and inflorescence densely pubescent. 14. *E. cuatrecasasii.*
    3. Calyx margin repand-denticulate to lobate.
      5. Corolla 6 mm long. 11. *E. ecuadorensis.*
      5. Corolla 2–5 mm long.
        6. Lateral pairs of nerves of leaf-blades 18–22 on each side.
          7. Flowers and fruits on slender pedicels 3–4 mm long; hypanthium minutely appressed-puberulent. 10. *E. laxiflora.*
          7. Flowers and fruits sessile or on pedicels at most 1 mm long; hypanthium moderately to densely hirtellous without.

8. Fruiting capsules aggregated, 3–3.5 mm high, 3–3.25 mm broad, densely hirtellous without; leaf-blades 20–26 cm long, 9–13 cm broad. 8. *E. obovata.*
8. Fruiting capsules solitary, not aggregated, 1.25 mm high, 1.5 mm broad, glabrous; leaf-blades 9–11.5 cm long, 5–6 cm broad. 9. *E. multinervia.*

6. Lateral pairs of nerves of leaf-blades 7–17 on each side.
  9. Lower three primary lateral axes of inflorescence alternate, the opposite pairs lacking. 2. *E. alterniramosa.*
  9. Lower primary lateral axes of inflorescence all opposite.
    10. Rachis and branches of inflorescence glabrous or glabrate; hypanthium glabrous without. 1. *E. utilis.*
    10. Rachis and branches of inflorescence variously pubescent; hypanthium pubescent throughout.
      11. Lower surface of leaf-blade more or less rough-papillose or puncticulate. 7. *E. maguirei.*
      11. Lower surface of leaf-blade not papillose or puncticulate.
        12. Flowers and/or fruits in sessile or subsessile glomerules or fascicles; corolla-lobes about equaling corolla-tube; capsules 1.25–1.75 mm, 1.75–2 mm broad. 6. *E. microcarpa.*
        12. Flowers and/or fruits scattered and solitary, or on peduncles up to 7 mm long; corolla-lobes chiefly longer than the corolla-tube; capsules 2.5–4 mm long, 2.5–4 mm broad.
          13. Branches of inflorescence minutely strigillose-puberulent; corolla 4 mm long; lateral pairs of nerves of leaf-blades 7–10 on each side. 5. *E. cubensis.*
          13. Branches of inflorescence more or less densely hirtellous; corolla 2.5–3.7 mm long; lateral pairs of nerves of leaf-blades 9–12 on each side.
            14. Calyx with prominent suborbicular lobes abruptly mucronately tipped; mature capsules (2.5–)3–4 mm high, 3–4 mm broad; corolla-lobes 2.7 mm long, corolla-tube 1 mm long. 3. *E. karstenii.*
            14. Calyx with broadly deltoid-triangular lobes rounded at summit; mature capsules 2.5–3 mm high, 2.5–3 mm broad; corolla-lobes 1.75–2 mm long, corolla-tube 1.75–2 mm long. 4. *E. mariae.*

1. **Elaeagia utilis** (Goudot) Wedd. Monogr. Cinch. 94. 1849.

Condaminea utilis Goudot, Compt. Rend. **18**: 260. 1844.

Type. Juxta Fusaguasuga [Colombia], *Goudot* (P).

Distribution. Andes of Colombia and Venezuela, at alt. 1650–3000 m.

The stipules of this species are persistent on the young leafy shoots, ovate-suborbicular, broadly rounded at apex, 1–2 cm long by 1–2 cm broad, and conspicuously recurved or revolute at the somewhat thickened tip. A fruiting specimen from Venezuela (*Aristeguieta 5249*) has glabrous capsules and branches of the inflorescence. It is tentatively referred to this species.

2. **Elaeagia alterniramosa** Steyermark, Acta. Biol. Ven. **4**(1): 35, *f. 16*. 1964.

Type. Arbolito, hoja verde semibrillante haz, corola blanca; Cordillera occidental, vertiente occidental, Hoja del Río Digua, Río San Juan, abajo de Queremal a la derecha del río entre km 52 y 53, Dept. del Valle, Colombia, at alt. 1300–1500 m, 19, 24, 27 Mar 1947, *José Cuatrecasas 23870* (holotype US). Known only from the type collection.

3. Elaeagia karstenii Standl. Field Mus. Bot. Ser. **8**: 50. 1930.

Elaeagia karstenii inhabits densely wooded areas of the Coastal Cordillera and Andes of Venezuela west to the Cordillera Central of Colombia at elevations of 1400–2700 m.

Key to the Forms of *Elaeagia karstenii*

1. Pubescence of leaf-blade beneath principally confined to the midrib and lateral nerves. f. *karstenii.*
1. Pubescence of leaf-blade beneath principally covering entire lower surface as well as on midrib and lateral nerves. f. *hispidula.*

The more pubescent-leaved f. *hispidula* Standl. & Steyerm. is of less frequent occurrence than f. *karstenii,* although occurring within the same general range. In addition to the denser pubescence of the lower leaf-surface, f. *hispidula* shows a tendency to have longer peduncles, more densely pubescent peduncles and branches of the inflorescence, more pubescent capsules, larger stipules, and a longer and looser inflorescence. It is possible that future collections may prove the f. *hispidula* to merit varietal or subspecific rank.

Although closely related to *E. utilis,* the two taxa are, in addition to the characters stated in the key, further differentiated by their stipules and calyx-lobes. In *E. karstenii* the stipules are rather thinnish in texture more or less uniform throughout, not recurved nor reflexed-thickened at apex, larger (4–5 cm long by 1.5–3.4 cm broad), often elongate or enveloping the petiole, or elongate; in *E. utilis* they are thicker, more reflexed and more truncate at the apex, more resinous, shorter, and stand out appressed to the stem and erect above the petioles. With respect to the calyx-lobes, those of *E. utilis* are shallow-deltoid and shorter as compared with the more lobulate and deeper ones of *E. karstenii.*

A photo of a specimen from B, deposited in F, NY, and US, labeled "*Gerontostoma macrophyllum* Kl. & Karst." is apparently an unpublished name. "*Karsten 67*" is indicated on the label. The photo shows a widely branched inflorescence with a moderate amount of puberulence on the lateral and ultimate branches. This indication of pubescence would appear to place this specimen under *E. karstenii.*

4. Elaeagia mariae Wedd. Monogr. Cinch. 94. 1849.

Type. Nemora calida montium, Provincia Carabaya [Peru], Junio fructiferam, *Weddell* (photo ex B).

Distribution. Peru and Bolivia, at alt. 1100–2000 m.

Examination of two photos of presumed type material at B does not offer conclusive satisfactory evidence for a study of this species. Both photos (numbers 63 and 64) are labeled "marked original in Schumann's handwriting, Prov. Carabaya, Puno, Peru, *Raimondi.*" Both show a prominent and reticulate tertiary venation on the lower surface of the leaf-blade, but the fruiting fragment on photo of no. 64 does not show whether the branches of the inflorescence are densely puberulent or glabrous. The capsules on the specimen of photo no. 64 appear to be solitary and pedicellate to 2 mm. The photo of no. 63 consists of a leafy shoot only, of which the leaf-blade beneath appears to be glabrous.

5. **Elaeagia cubensis** Britton, Bull. Torrey Bot. Club **39**: 10. 1912.

Type. Monte Jiquarito, Sierra Maestra [Cuba], 18 Sep 1906, alt. 1100 m, *Norman Taylor 515* (NY).

Distribution. Known only from the Oriente of Cuba at alt. 1100–1800 m.

6. **Elaeagia microcarpa** Steyermark, sp. nov.

Arbor 16–17-metralis; foliis petiolatis, petiolis 10–15 mm longis dense puberulentibus vel glabratis; laminis oblongo-obovatis vel obovato-oblongis apice rotundatis vel obtusis basi subobtusis vel subacutis 12–17 cm longis 6–9 cm latis, subtus in axillis nervorum tantum hispidulis, ceterum glabris vel glabratis, nervis lateralibus utroque latere 12–13; inflorescentia 3.5–8.5 cm longe pedunculata, 17–23 cm longa 10–12 cm lata inferne moderatim superne dense puberulenti; pedicellis ad 0.5 mm longis puberulentibus; floribus solitariis vel 3–4-floris, sessilibus vel pedicellatis; hypanthio subcampanulato in anthesi 1.5 mm alto 1.5 mm lato in fructu ad 2 mm alto 1.75 mm lato, extus dense puberulo; calycis tubo 0.2–0.3 mm alto 0.5 mm lato extus dense puberulo intus glabro apice leviter repando-denticulato; corolla subrotata 3 mm longa, tubo 1.5 mm longo basi 1.2 mm lato extus glabro intus fauce barbato ceterum glabro, lobis 2 mm longis 1 mm latis utrinque glabris; staminibus exsertis, antheris ovato-oblongis 1.3 mm longis; filamentis 1.8 mm longis glabris; stylo 2.5 mm longo glabro; fructibus glomeratis sessilibus vel subsessilibus 1.25–1.75 mm altis 1.75–2 mm latis dense hirtellis; calycis lobis fructigeris deltoideo-lobatis.

Type. Tree 16–17 m, at alt. 690–750 m, Basin of Río Bopi, Asunta (near Evenay), Province of S. Yungas, Dept. La Paz, Bolivia, 27–31 Jul 1939, *B. A. Krukoff 10650* (holotype US, isotype NY). Paratype. Tiuri (near Mapiri, on left bank of Río Mapiri), alt. 490–750 m, Province of Larecaja, Dept. La Paz, Bolivia, 12–30 Sep 1939, *Krukoff 10928* (NY).

This species differs from *E. maguirei* Steyerm. in the smaller corollas and capsules, and in the non-pustulose, non-papillate lower surface of the leaf-blades.

7. **Elaeagia maguirei** Standl. Bull. Torrey Bot. Club **75**: 568. 1948.

Key to the Varieties of *Elaeagia maguirei*

1. Lower surface of leaf-blade glabrous or nearly so; spreading hairs few or moderate in number along midrib of lower surface of leaf-blade at or near axils of main nerves and sometimes at base of lateral nerves; corolla 4–4.5 mm long, the tube 2–2.5 mm long; peduncle appressed-puberulous. var. *maguirei*.
1. Lower surface of leaf-blade markedly pubescent; spreading hairs abundant on midrib and lateral nerves of lower surface of leaf-blade; corolla 3.8 mm long, the tube 1.8 mm long; peduncle densely hirtellous with spreading hairs. var. *pubens*.

7a. **Elaeagia maguirei** var. **maguirei**.

Type. Tree to 15 m high, 30 cm diam, flowers white, frequent; high forest, base south cliffs, Arrowhead Basin, alt. 625 m, Tafelberg, Suriname, 23 Aug 1944, *Bassett Maguire 24449* (holotype F, isotypes NY, VEN).

Distribution. Suriname, British Guiana, and Venezuela, where confined to the sandstone table-mountains at altitudes up to 1800 m. BRITISH GUIANA. Mt. Ayanganna, Pakaraima Mts., *Tillett, Tillett & Boyan 44994.* VENEZUELA. Edo. Bolívar: northwestern part of Abacapá-tepuí, Chimantá Massif, at alt. 1210–1600 m, *Steyermark 75067;* Agparaman-tepui, Chimantá Massif, at alt. 1365 m, *Steyermark & Wurdack 1244;* Cerro Venamo, at alt. 1100–1140 m, *Steyermark & Nilsson 434*. Terr. Amazonas: Serranía Paru, at alt. 1800 m, *Cowan & Wurdack 31399;* Cerro Huachamacari, at alt. 1100 m, *Maguire, Cowan & Wurdack 29936;* Cerro Yutaje, at alt. 1500 m, *Maguire & Maguire 35371, 35191;* Cerro Duida, at alt. 1905 m, *Steyermark 57990.*

7b. **Elaeagia maguirei** var. **pubens** Steyermark, var. nov.

Stipulae extus dense hispidulae; foliorum lamina subtus manifeste pubescenti, costa media nervis lateralibusque subtus pilis patentibus numerosis hispidulis instructis, nervulis tertiariis minute pilosulus, superficie subtus papillato-rugosa; hypanthio 0.6 mm alto arceolato extus hispidulo; calyce 0.8–0.9 mm alto apice 5-repando-denticulato, lobis late deltoideo-triangularibus; inflorescentia 5–6 cm longe pedunculata, pedunculo dense hispidulo; floribus sessilibus solitariis vel plerumque 2–5-fasciculatis; corolla 3.8 mm longa, tubo 1.8 mm longo.

Type. Tree 10 m high, calyx yellow-green, corolla and filaments white; tall forest in drainage of Río Aponguao, vicinity of km 143 south of El Dorado, northeast of Luepa at 800–1200 m alt, Estado Bolívar, Venezuela, 6–11 Mar 1962, *J. A. Steyermark & L. Aristeguieta 102* (holotype VEN). Known only from the type locality.

From the pubescent variation of *Elaeagia karstenii* f. *hispidula* Standl. & Steyerm., *E. maguirei* var. *pubens* is distinguished by the glomerulate sessile or subsessile flowers, repand instead of prominently lobed calyx, corolla-lobes about equaling instead of longer than the corolla-tube, shorter and more strongly pubescent (hirtellous) capsules, shorter stipules, and by the strongly papillate-asperulous instead of conspicuously reticulate lower surface of the leaf-blades.

In specimens from British Guiana and Venezuela there is some variation in var. *maguirei* as to degrees of pubescence and papillosity on the lower leaf-surface. Some specimens exhibit a stronger degree of papillosity and white punctateness, together with a greater amount of spreading pubescence along the midrib of the lower leaf-surface, than others. Others show a denser, more spreading, hirtellous pubescence on the peduncles and lower part of the rachis than do others. In general, var. *maguirei* has the peduncle appressed-puberulous and the main rachis minutely hirtellous to subspreading-pubescent on the upper branches, and the lower leaf-surface beneath has usually conspicuous papillate or raised, puncticulate, white areas, with only few spreading hairs along the lower midrib and lateral axils. In var. *pubens* the papillae on the lower leaf-surface produce hairs more abundantly at their tips, the midrib and lateral nerves have a denser hispidulous pubescence, the entire length of the peduncle and rachis, and branches of the inflorescence are densely hirtellous with a more spreading pubescence, and the corolla is shorter.

8. **Elaeagia obovata** Rusby, Descr. New Sp. S. Am. Pl. 130. 1920.

Type. Yungas, Bolivia, at alt. 1800 m, 1885, *H. H. Rusby 2447* (NY).
Distribution. Known with certainty only from Bolivia.

9. **Elaeagia multinervia** Steyermark, Act. Biol. Venez. **4**(1): 40, *f. 18.* 1964.

Type. Vertiente oriental de la Cordillera, entre El Silencio y La Cabaña (carretera de Sibundoy a Urcusique), Comisario del Putumayo, Colombia, at alt. 2200–2400 m, 31 Diciembre 1940, *José Cuatrecasas 11513* (holotype US). Known only from the type locality.

10. Elaeagia laxiflora Standl. & Steyerm. Fieldiana Bot. **28**: 574. *fig. 123.* 1953.

Type. Shrub 6 m; leaves firmly membranaceous; filaments and style white; corolla lobes recurved-revolute, white; calyx and peduncle and pedicels pale green; forested slopes of headwaters of tributaries of Río Neverí, between Río León and ''Carmelita,'' northeast of Bergantín, state of Anzoátegui, at alt. 800–1200 m, 5 Mar 1945, *Julian A. Steyermark 61373* (holotype F).

Distribution. Coastal Cordillera of eastern Venezuela in the states of Sucre and Anzoategui. In addition to the type collection, the species is represented by the following collection: Cerro Patao, norte de Puerto de Hierro, estado Sucre, *Steyermark & Agostini 91190.*

11. Elaeagia ecuadorensis Steyerm. Bol. Soc. Venez. Cienc. Nat. **21**: 242. 1960.

Type. Tree 9–15 m; corolla white; calyx green; flowers very fragrant, nodding; filaments white; leaves coriaceous, dark green above, dull green below; common; between Pailas and El Pan, province of Santiago-Zamora, Ecuador, at alt. 2255–3445 m, 10 Sep 1943, *Julian A. Steyermark 54305* (holotype F). Known only from the type collection.

12. Elaeagia barbata Steyermark, sp. nov.

Arbor 4-metralis; foliis petiolatis, petiolis 10–12 mm longis puberulentibus; laminis elliptico-obovatis apice obtuse subacutis vel acuminatis basi cuneatim subacuminatis 9–14.5 cm longis 4.5–8 cm latis, supra glabris subtus in axillis nervorum cum costa media manifeste barbatis, costa media nervis lateralibusque subtus sparse ad moderate puberulis, nervis lateralibus utroque latere 10–12; inflorescentia 1.5–3.5 cm longe pedunculata, fructigera 17 cm longa 17–18 cm lata, ramis inferioribus patentibus, rhachi ramisque puberulis; bracteis patentibus lineari-subulatis 3–4.5 mm longis, superioribus brevioribus; calycis lobis acute deltoideis 0.5 mm altis 0.6–0.7 mm latis; capsulis subglobosis 3 mm altis 2–2.5 mm latis.

Type. Arbolillo de 4 m; bosques virgenes, Hoya del Río Cali, ''El Recuerdo,'' Cali, Cordillera Occidental, Dept. del Valle, Colombia, at alt. 1800 m, *J. M. Duque 1559* (holotype US).

This species is characterized by the tufts of barbate hairs occurring on the lower leaf surface in the axils of the midrib and lateral nerves.

13. Elaeagia asperula Standley ex Steyermark, Act. Biol. Venez. **4**(1) : 37. 1964.

Type. Arbol 20 m, tallo 30 cm diam; hoja membranosa, rigida, verde clara; yema terminal envuelto en resina seca, brillante; La Trojita, Río Calima (region del Chocó), Dept. del Valle, Colombia, at alt. 5–50 m, 19 Febrero–10 Marzo 1944, *José Cuatrecasas 16647* (holotype US). Known only from the type collection.

14. Elaeagia cuatrecasasii Steyermark, Act. Biol. Venez. **4**(1) : 38, *f. 17.* 1964.

Type. Arbol; hoja verde oscura haz, verdoso grisácea envés; cáliz verde con borde blanco; corola blanca; filamentos blancos; anteras amarillo claro; aromatica; Hoja del Río Cali, lado derecho del Río Pichindé, en La Palma, vertiente oriental, Cordillera Occidental, Dept. del Valle, Colombia, at alt. 2500 m, 24 July 1946, *José Cuatrecasas 21682* (holotype US). Known only from the type collection.

15. **Elaeagia magniflora** Steyermark, Bol. Soc. Venez. Cienc. Nat. **21**: 242. 1960.

Type. Arbol de unos 12 m; flores cremosas; selva nublada del Parque Nacional "Henri Pittier," Rancho Grande, estado Aragua, Venezuela, Agosto 1953, *Leandro Aristeguieta 1989* (holotype VEN).

Distribution. Known only from cloud forest of Parque Nacional "Pittier," state of Aragua, at alt. 1300–1600 m.

Excluded Species

Elaeagia brasiliensis Standl. in Gleason & A. C. Smith, Bull. Torrey Bot. Club **60**: 395, 1933. = **Chimarrhis turbinata** DC.

The septicidally dehiscent capsules, pubescent capsules and branches of the inflorescence, sparsely barbate leaf axils, stipules, and other characters match authentic material of *Chimarrhis turbinata,* and leave no doubt of conspecificity of the two taxa.

Elaeagia glomerifera Standl. Field Mus. Bot. Ser. **7**: 281. 1931. = **Bathysa** aff. **australis** Hook. f.

The capsules are definitely septicidal, although Standley describes them as loculicidal. The specimen of the paratype (*Krukoff 10366*) is in fruit and difficult to place definitely in one or the other of the genera. It resembles *Bathysa australis* Hook. f. as well as some species of *Chimarrhis.* The photo of the type at K (*Pearce*) resembles *Bathysa australis.*

Elaeagia grandis Rusby, Mem. Torrey Club **4**: 208. 1895.

Standley placed this species under *Elaeagia* in his Rubiaceae of Bolivia, but it is obviously not this genus. The 5–6-lobed corolla, 5–6 stamens, conspicuously dentate 5–6-lobed calyx, and other characters would exclude it from *Elaeagia,* and the multi-ovulate cells of the ovary would exclude it from *Malanea,* with which it has also been filed in some herbaria.

Elaeagia mollis Rusby, Descr. New Sp. S. Am. Pl. 130. 1920. = **Bathysa** sp.

Elaeagia subspicata Standl. Field Mus. Bot. Ser. **11**: 203. 1936. = **Warszewiczia longistaminea** Schum.

The capsules in the type material are septicidally instead of loculicidally dehiscent and are longer than broad. The peculiarly lineolate leaf-blades are characteristic of species of *Warszewiczia,* and there is no enlarged stipule such as is characteristic of species of *Elaeagia.* The seeds are honeycombed and suborbicular.

Tribe Gardenieae

Tocoyena Aubl. Pl. Guian. **1**: 131. *t. 50.* 1775.

Type species. *T. longiflora* Aubl.

As presently understood, the genus is exclusively South American, extending south to southern Brazil, Paraguay, Bolivia, and Peru. The species all have very elongated and slender corolla-tubes.

The following treatment is confined to species of the Guayana.

Key to Species of *Tocoyena* of Guayana

1. Calyx and hypanthium externally pubescent; corolla-tube externally pubescent.
  2. Upper leaf-surface glabrous, only the midrib and lateral nerves pubescent; corolla bud obtuse. 5. *T. surinamensis.*
  2. Upper leaf-surface, together with midrib and lateral nerves, pubescent; corolla bud acutely pointed.
    3. Lower leaf-surface with a prominent, dense, velvety gray-buff reticulate tomentum on the tertiary veins; corolla-lobes 2.5–3.8 cm long; corolla tube 7.5–8.5 cm long; leaf-blades 8.5–19.5 cm long, 4.5–13 cm broad; calyx-teeth 0.75–4 mm long; plants of British Guiana and estado Bolívar, eastern Venezuela. 7. *T. neglecta.*
    3. Lower leaf-surface without a prominent reticulate indument of the tertiary veins evident between the lateral nerves; corolla-lobes 2–2.2 cm long; corolla-tube mainly 9–10.2 cm long (rarely shorter); leaf-blades 6.5–11 cm long, 3–6.5 cm broad; calyx-teeth 0.3–0.6 mm long; plants of Territorio Federal Amazonas, western Venezuela. 6. *T. brevifolia.*
1. Calyx and hypanthium externally glabrous; corolla-tube externally glabrous.
  4. Leaf-blades rounded or broadly obtuse at apex. 4. *T. pendulina.*
  4. Leaf-blades acute, acuminate, or caudate at apex.
    5. Calyx-teeth prominent, 2–2.5 mm long; corolla-lobes subacute to obtuse or rounded. 1. *T. longiflora.*
    5. Calyx-teeth 0.3–0.8 mm long; corolla-lobes acute to acuminate.
      6. Corolla-tube 6.5–9 cm long; corolla-lobes 2.2–2.3 cm long; lateral nerves of leaf-blades 7–11 on each side; petioles 0.2–1 cm long; leaf-blades 7–13 cm long, 3–8 cm wide. 2. *T. orinocensis.*
      6. Corolla-tube 15–27 cm long; corolla-lobes 3.5–6.5 cm long; lateral nerves of leaf-blades 11–16 on each side; petioles 2–3.5 cm long; leaf-blades 15–29 cm long, 7.5–16 cm wide. 3. *T. guianensis.*

1. **Tocoyena longiflora** Aubl. Pl. Guian. **1**: 131. *t. 50.* 1775.

Type. In sylvis prope Aroura, French Guiana, *Aublet.*

Distribution. Known only from French Guiana. Besides the type, two other collections are referable here: Unbranched shrub about 1.5–2 m tall; forest shade, 0.2–0.5 km south of Cachoeira Tres Saltos, 2° 12′ N, 52° 53′ W, French Guiana, 13 Sep 1960, *Irwin, Pires & Westra 48227;* high forest, Montagne de Kaw, at 225–270 m alt., *Cowan 38790.*

The cited collection of *Irwin, Pires & Westra* is the one most closely agreeing with *pl. 50* of Aublet's *T. longiflora.* Although Aublet described the corolla-lobes as acute, his plate shows the corolla-buds and lobes subacute or subobtuse. In the *Irwin, Pires & Westra* collection, the lobes are rounded and the buds are obtuse. Aublet notes the presence of calycine squamellae. In the *Irwin, Pires & Westra* specimen these are present as groups of 4–6 situated below the sinuses of the calyx-lobes. The dentate calyx-tube, described and illustrated by Aublet, is also present in the *Irwin, Pires & Westra* specimen.

2. **Tocoyena orinocensis** Standley & Steyermark, Fieldiana Bot. **28**: 617. 1953.

Type. Among rock outcrops below mouth of Río Sanariapo, along Orinoco River, Territorio Federal Amazonas, Venezuela, at alt. 100 m, 8 Sep 1944, *Julian A. Steyermark 58442* (holotype F).

Distribution. Known only from igneous rock outcrops bordering the Orinoco River, Amazonas, Venezuela. In addition to the type collection, the following are referable here: At edge of crystalline laja, 1–2 km east of Hotel Amazonas, Puerto Ayacucho, *Maguire, Wurdack & Bunting 36074;* lugares poco humedos de las lajas, unos 10 km al sur del Puerto Ayacucho, *Foldats 3585;* cerca del

Puerto Ayacucho, sobre lajas, *Foldats 3528;* banks of the Orinoco, *Chaffanjon 184.*

3. Tocoyena guianensis K. Schum. in Mart. Fl Bras. **6**(6) : 346. 1889.

Key to the Varieties of *Tocoyena guianensis*

1. Corolla-tube 15 cm long; stipules glabrous externally, subacute to subobtuse at apex; leaves glabrous below except for sparsely pubescent axils of lateral nerves and scattered pubescence along midrib. var. *glabriuscula.*
1. Corolla-tube 17–27 cm long; stipules pubescent externally, acute, caudate, or cuspidate; leaves densely pubescent below on midrib and lateral nerves.
  2. Upper leaf-surface glabrous or sparsely pubescent with scattered hairs; lower leaf-surface glabrous or nearly so, excepting the midrib and lateral nerves. var. *communis.*
  2. Upper leaf-surface abundantly pubescent; lower leaf-surface densely pubescent. var. *guianensis.*

3a. Tocoyena guianensis K. Schum. var. **guianensis.**

Type. Cayenne, French Guiana, *Martin 316* (photo of type from B at NY).

Distribution. French Guiana and states of Pará, Amapá, and Maranhao, Brazil. BRAZIL. Pará: in paludosis ad flumen Curicambá, Obidos, *Ducke 22906.* Amapá: between Cachoeira Mucurú, 0° 32′ N, 53° 8′ W, and Cachoeira do Repoto, at alt. ca. 160 m, *Egler & Irwin 46569.* Maranhao: Maracassumé River region, *Froes 1741.*

The photo of the type specimen shows the midrib and lateral nerves of the leaf-blades with abundant pubescence of a spreading hispid type. This is well matched by the *Ducke 22906* specimen cited above. In the other collections cited, the pubescence on the lower midrib and lateral nerves is of a more appressed-strigose type. The lower surface of the leaf-blades in the type photo shows abundant pubescence, although Schumann describes (Fl. Brasil. p. 346) the leaves as ''supra pilis inspersis, demum nervis exceptis glabratis subtus hispidis scabridis,'' a statement which does not too well match the evident pubescence shown on the type photo. None of the variations of *T. guianensis,* including the specimens examined of *T. guianensis* var. *guianensis,* other than that of *Ducke 22906,* show anything except a strigose, non-spreading type of pubescence on the midrib and lateral nerves of the lower leaf-surface.

3b. Tocoyena guianensis K. Schum. var. **communis** Steyermark, var. nov.

A var. *guianensis* differt laminis foliorum supra glabris vel pilis remotis sparse pubescentibus, subtus glabris vel fere glabris, costa media nervis lateralibusque densiuscule pubescentibus exceptis.

Type. Small tree 5 m tall, 6 cm diam; corolla white; shade at margin of river, Rio Oiapoque, opposite Pedro Alice, 3° 40′ N, 52° 1′ W, Territorio Amapá, Brazil, 18 Aug 1960, *H. S. Irwin, J. M. Pires & L. Y. Th. Westra 47620* (holotype NY). Paratypes. BRAZIL. Amapá: Rio Araguari, along river between Camps 5 and 6 and tin mine trail, 1° 26′ N, 51° 58′ W, and 1° 9′ N, 51° 52′ W, *Pires, Rodrigues & Irvine 50788;* Rio Araguari, varzea forest, Camp 13, 1° 45′ N, 25° W, *Pires, Rodrigues & Irvine 51600.* FRENCH GUIANA. Rio Oiapoque, between Pedro Alice, 3° 40′ N, 52° 1′ W, French Guiana, and Roche Mon Pere, 3° 33′ N, 52° 5′ W, Brazil, *Egler 47640.* Crique Alikene, about 50 km from its confluence with River Camopi, ca. 3° 10–20′ N, 52° 28–32′ W, *Pires 48580;* about 1 km west of Cachoeira Utussansain, 2° 8′ N, 52° 55′ W, *Irwin, Pires & Westra*

48072. VENEZUELA. Territorio Federal Amazonas: Río Siapa just above Raudal Gallineta, *Wurdack & Adderley 43532.*

A specimen from French Guiana (*Irwin, Pires & Westra 47993* from Cachoeira Utussansain) is a more scabridulous-leaved form, in which the upper surface of the leaf-blades are more scabridulous, and the nerves of the upper leaf surface are more densely strigose; the petioles also are more densely hirtellous-scabridulous.

3c. Tocoyena guianensis K. Schum. var. **glabriuscula** Steyermark, var. nov.

A var. *guianensis* differt stipulis extus glabris apice subacutis vel subobtusis, corollae tubo 15 cm longo, foliorum laminis subtus glabris axillis nervorum lateralium sparse pubescentibus et costa media sparse pubescenti exceptis, supra laminis glabris vel fere glabris.

Type. Shrub 3–4 m; flowers pale yellow; occasional on lower slopes of Piedra Cucuy, Río Negro, Territorio Federal Amazonas, Venezuela, at alt. 100–200 m, 9 Apr 1953, *Bassett Maguire & John J. Wurdack 34923.*

This taxon may have to be considered perhaps eventually as a species distinct from *T. guianensis,* because of its combination of shorter corolla-tube and lobes, glabrous shorter-pointed stipules, and mostly glabrate leaves. However, this conclusion cannot be made until more collections reveal the extent of variation existing in the length of the corolla-tube and degree of glabrity versus pubescence of the leaves and stipules. At present, it is apparent that transitions exist among the varieties of *T. guianensis* between a glabrate lower and upper leaf-surface to one more pubescent, as well as glabrate to pubescent lower and upper midribs. Also, the relative lengths of the corolla-tube may eventually show intergrading measurements between the varities considered in the present treatment.

4. Tocoyena pendulina Spruce ex Standl. Field Mus. Bot. Ser. **7**: 391. 1931.

Type. Prope Tomo in ripis fluminis Guiainiae, Venezuela, Aug 1854, *R. Spruce 3552* (holotype K, fragment of holotype and photo from K at F).

Distribution. Small to medium-sized tree in savanna and river margins in drainage of Río Guainía, Amazonas, Venezuela, at alt. 120–150 m. In addition to the type specimen, the following are referable to this species: margen arboreada y periodicamente anegada, en la boca del Caño Ichana, Bajo Caño San Miguel, Río Guainía, *Williams 14885;* sabanita on right bank of Río Pacimoni, 12 km below mouth of Río Yatua, *Maguire, Wurdack, Keith & Maguire 41656.*

5. Tocoyena surinamensis Bremekamp, Rec. Trav. Bot. Néerl. **33**: 710. 1936.

Type. Upper Sipaliwini River, Platte Berg, Surinam, *Rombouts 323* (holotype U, isotype US).

Distribution. Known only from Suriname.

An examination of the isotype collection shows the corolla-lobes to be rounded or obtuse at the apex, a distinction not mentioned in the original description. The corolla-lobes are 10–11 mm long, 7 mm broad, glabrous within, and densely tomentose without. This species differs from the related *T. neglecta* N. E. Br. in having smaller corolla-lobes 10–11 mm long and 7 mm broad instead of 25–38 mm long by 13–17 mm broad, broadly triangular calyx-lobes equaling the calyx-tube instead of setaceous and shorter than the tube, obtuse corolla-lobes, longer petioles, and glabrous upper leaf-surface.

6. **Tocoyena brevifolia** Steyermark, sp. nov.

Arbor 15-metralis vel frutex; stipulis late deltoideis vel late ovatis longi-acuminatis 3 mm longis extus stramineo-strigosis; foliis petiolatis, petiolis 6–7 mm longis dense hirtellis; laminis elliptico-obovatis apice abrupte acuminatis, acumine 5–8 mm longo, basi conspicue angustatis 6.5–11 cm longis 3–6.5 cm latis, supra dense molliterque velutino-hirtellis, subtus molliter denseque pilis fuscis velutino-hirtellis, subtus costa media nervis lateralibusque magis densiuscule hirtellis; nervis lateralibus utroque latere 7–9 adscendentibus; inflorescentia terminali 7–10-flora pedunculata; pedunculis principalibus tribus 3–5 mm longis dense hirsutulis; pedicellis 1–2 mm longis hirsutulis; calyce hypanthioque cylindrico-turbinato 4–4.5 mm longa 2–3 mm lato abundante stramineo-hirsutulo 5-dentato, dentibus lineari-oblongis 0.3–0.6 mm longis; corolla in alabastro apice acuta hypocrateriformi, tubo 7–10.2 cm longo superne in faucem 5 mm longam 10 mm latam abrupte ampliato extus abundante hirtello, lobis 5 ovatis subacutis 2–2.2 cm longis 7–9 mm latis extus dimidia parte hirtello-pulverulenti dimidia parte glabrata, intus granulari-pulverulentibus, marginibus ciliatis; antheris 5 lineari-oblongis apice rotundatis 7 mm longis; stylo tubum corollae aequanti; stigmatibus spathulatis 5.5 mm longis.

Type. Arbusto de 2.5 m con flores amarillo fuerte; en la margen de la laja Carestia, bajo Sanariapo, Territorio Federal Amazonas, Venezuela, at alt. 120 m, 7 May 1942, *Llewelyn Williams 16039* (holotype VEN, isotype F). Paratypes. VENEZUELA. Territorio Federal Amazonas: en las rebalsas arboreadas de Puerto Ayacucho, at alt. 120 m, *Williams 15939* (F); Puerto Zamuro on the Orinoco, *Gaillard 96* (F, P); edge of crystalline laja, 1–2 km east of Hotel Amazonas, Puerto Ayacucho, at alt. 100–120 m, *Maguire, Wurdack & Bunting 36074*.

This taxon is related to *T. neglecta* N. E. Br., from which it differs in the longer corolla-tube, shorter corolla-lobes, shorter, more depressed calyx-lobes, relatively shorter and narrower leaves, and lower leaf-surface with prominent lateral nerves only evident and without the gray-pubescent reticulate network of tertiary venation so characteristic in *T. neglecta* and *T. formosa* (Cham. & Sch.) Schum.

The collectors' notes give the color of the corolla as ''cream'' (*Maguire, Wurdack & Bunting*) or ''amarillo fuerte'' (*Williams*). The yellow color recorded is probably the result of ageing of the corolla, as noted by Foldats in his specimen of *T. orinocensis* (*Foldats 3528*), as changing from green in bud, white in anthesis, to finally yellow and yellow-orange in age.

7. **Tocoyena neglecta** N. E. Brown, Trans. Linn. Soc. II, **6**: 35. 1901.

Type. Maimatta, on the Rupununi River, British Guiana, October 1889, *Jenman 5525* (holotype K, photo of type from K at NY).

Distribution. Shrub with white to creamy-white fragrant flowers on rocky outcrops and borders of savannas in British Guiana and Estado Bolívar, southeastern Venezuela, at alt. 175–420 m. BRITISH GUIANA. Maimatta, Rupununi River, *Jenman 5525* (type); Roraima, *Schomburgk 478;* Sand Creek, Rupununi River, Forest Dept. Field No. WB 107, Record No. *5648*. VENEZUELA. Estado Bolívar: Isla Casabe, Río Paragua, *Maguire 32711;* savanna by Río Asa, above Raudal Cotua, south of La Paragua, *Steyermrk 86743;* Raudal Perro, Río Paragua, *Cardona 795;* Salto Hacha, Río Carrao, zona rocosa al norte del salto Hacha,

Canaima, *Blohm 3;* laja just south of Río Chiguirete, Hato La Vergareña, *Wurdack & Guppy 25.*

This species has generally been misidentified as *T. formosa* (Cham. & Schl.) Schum. The latter is a species of southern and central Brazil and Paraguay. *Tocoyena neglecta* differs from *T. formosa* in the pointed elongated corolla-buds instead of ellipsoidal obtuse or rounded buds of *T. formosa,* in the acute or subacute instead of rounded corolla-lobes in anthesis, the moderately hirtellous calyx, the surface of which is visible between the hairs instead of densely velutinous and not visible as in *T. formosa,* and in the much longer and broader corolla-lobes. Much of the confusion between these two taxa is due to the similarity of pubescence on the lower surface of the leaf-blades, which is of a velvety tomentum with a reticulate tertiary venation, but the two taxa are amply distinct in the other characters given above.

Notes on other species of *Tocoyena* not included above

Tocoyena foetida Poepp. & Endl. Nov. Gen. & Sp. **3**: 25. *pl. 229.* 1845.

This species was reported by Standley (Field Mus. Bot. Ser. **7**: 390. 1931) from Venezuela (*Gaillard 96* from Puerto Zamuro on the Orinoco) and by Schumann (in Martius, Fl. Bras. **6**(6): 346. 1889) from Venezuela (*Spruce 3582* from Maipures). The *Gaillard* specimen proves to be *T. brevifolia* Steyermark. I have not seen the *Spruce* collection, but there is no evidence that *T. foetida* is found outside of Brazil and Colombia. The following specimens may be referred to *T. foetida.* BRAZIL. Ad ripas inundatas, Rio Jacurapá affluente Rio Jea inferiore, Amazonas, *Ducke 24377;* Ega, *Poeppig 2801* (type collection). COLOMBIA. Amazonas: Trapecio amazonico, Loretoyacu River, *Schultes 6724.*

The *Schultes 6724* specimen possesses fruit.

Tocoyena sprucei Standl. Field Mus. Bot. Ser. **8**: 350. 1931.

This species has very rugulose reticulately nerved leaves both above and below. The photo of the type from Kew at US shows obtuse corolla-buds and obtuse corolla-lobes with a corolla-tube 6.5 cm long, corolla-lobes 6–7 mm long, petioles 4–5 mm long, and leaf-blades 8–8.5 cm long, 6.2–6.5 cm wide, broadly rounded at apex, and obtuse at the base. A specimen from the state of Pará, Brazil at NY (Santarém, *Froes 20453*) is referable to this species.

Tocoyena velutina Mart. Flora **24**, II Beibl. 81. 1841.

Type. Cujabá, Mato Grosso, Brazil, *Martius.*

The species is described as having the calyx ''subulato-dentato et corollae tubo ultra bipollicari dense velutinis'' and the corolla lobes as being ''obtusis.'' These characters would serve to distinguish it from *T. neglecta* which has acute or subacute corolla-lobes and does not have a densely velutinous calyx. The description and locality of collection of *T. velutina* would indicate that it be placed into synonymy with *T. formosa* instead of with *T. foetida,* as Schumann has done, because the lower side of the leaf-blade in *T. velutina* is described as ''dense velutino-tomentosis.'' This fits *T. formosa* more accurately than it does *T. foetida.* Moreover, *T. foetida* has acute to acuminate corolla-lobes instead of obtuse or rounded lobes as in *T. formosa.* On the other hand, the ''subulato-dentato'' calyx fits *T. foetida* better than *T. formosa.*

The specimens collected by Jenman in British Guiana (*Jenman 5525*), identified as "near *T. velutina*," prove to be *T. neglecta* N. E. Brown.

Excluded Species

Tocoyena mutisii HBK. Nov. Gen. & Sp. **3**: 411. 1818. = **Posoqueria latifolia** (Rudge) R. & S.

Duroia L. f. Suppl. Pl. 30. 1781.

Type species. *D. eriopila* L. f.

Duroia is one of the dioecious genera of the tribe Gardenieae. Some of the species are still known only from staminate collections. Doubtless, many more species remain to be discovered. The present treatment is based on material studied from the herbaria of the Chicago Natural History Museum, New York Botanical Garden, United States National Museum, Instituto Botanico of Caracas, and Jardim Botanico de Rio Janeiro.

Key to the Species of *Duroia*

1. Leaves with inflated vesicles or pouches at their base.
2. Leaves 3-verticillate, hirsute below at least on midrib and nerves; staminate corolla-tube usually longer than the corolla-lobes; petiole 0.2–0.7 cm long; vesicles of leaves well-developed, 7–15 cm long, ovoid or rounded. 25. *D. saccifera.*
2. Leaves 5-verticillate, minutely pubescent below; staminate corolla-tube shorter than the corolla-lobes; petiole 6–10 cm long; vesicles of leaves smaller and less developed. 26. *D. plicata.*
1. Leaves without inflated vesicles or pouches at their base.
3. Base of leaf-blades cordate. 24. *D. aquatica.*
3. Base of leaf-blades not cordate.
4. Summit of staminate and pistillate calyx-tube with elongated setaceous hispid lobes 6–10 mm long equaling or nearly equaling the calyx-tube. 1. *D. hirsuta.*
4. Summit of staminate and pistillate calyx-tube truncate, without teeth or lobes or these much shorter than the calyx-tube.
5. Petiole 4.5–8 cm long, densely tomentulose; staminate calyx 11–20 mm long. 22. *D. macrophylla.*
5. Petiole 0.2–4 (rarely to 5) cm long, if exceeding 4 cm then glabrous or nearly so; staminate calyx 2.5–13 mm long.
6. Staminate calyx 12–13 mm long. 21. *D. martiniana.*
6. Staminate calyx 2.5–11 mm long.
7. Lower surface of leaf-blades with soft ferruginous brown velutinous pubescence; staminate calyx densely ferruginous velutinous-hirsutulous without. 20. *D. velutina.*
7. Lower surface of leaf-blades glabrous to strigillose or hirsutulous, but not ferruginous-velutinous; staminate calyx glabrous to sericeous or variously strigose without, but not densely ferruginous velutinous-hirsutulous.
8. Calyx-tube of staminate flowers about 10 mm long, densely stramineous strigillose-hirsutulous over entire surface without; lower surface of leaf-blade asperulo-hirsutulous; pistillate calyx 3-lobed, the lobes ovate-oblong, 6 mm long, 6 mm broad. 23. *D. amapana.*
8. Calyx-tube of staminate flowers mainly 2.5–8 mm long, if longer the pubescence short sericeous without over part of outer surface; lower surface of leaves glabrous to strigose or puberulous, but not asperulo-hirsutulous; pistillate calyx truncate or 4–6-repand-denticulate, the denticulations 1 mm or less long and about as broad.
9. Pedicels of staminate flowers greatly elongated, 20–30 mm long; interior of tube of staminate corolla densely strigose in upper half. 2. *D. kotchubaeoides.*

9. Pedicels of staminate flowers none or up to 13 mm long; interior of tube of staminate corolla sparsely puberulous or pilosulous near base.

10. Staminate calyx within glabrous. 3. *D. duckei.*

10. Staminate calyx within sericeous.

11. At least the midrib and/or lateral nerves on lower and/or upper side of leaf pubescent.

12. Leaves opposite.

13. Apical parts of stems strigillose to glabrate; pedicels of staminate flowers 5–7 mm long, sericeous-strigillose; calyx of staminate flowers 6–8 mm long. 5. *D. strigosa.*

13. Apical parts of stems hirsute or hirsutulous with spreading hairs; pedicels of staminate flowers none or very short, up to 4 mm long, hirsutulous; calyx of staminate flowers 3–5 (rarely to 6.5) mm long. 4. *D. eriopila.*

12. Leaves 3–4-verticillate.

14. Peduncles of staminate inflorescences none or up to 4 mm, the flowers appearing densely fasciculate or umbellate.

15. Interior of staminate corolla glabrate; pistillate flower solitary and sessile; ovary pubescent; staminate calyx loosely to densely ferruginous-hirsutulous or substrigose with hairs up to 1 mm long; petioles ferruginous-hirsute throughout. 6. *D. palustris.*

15. Interior of staminate corolla puberulous near base; pistillate flowers in 3's and peduncled; ovary glabrous; staminate calyx densely stramineous short-strigose or subsericeous, the hairs 0.2–0.5 mm long; petioles glabrous or somewhat strigose. 7. *D. petiolaris.*

14. Peduncles of staminate inflorescences more or less evident, mainly 5–30 mm long, the flowers appearing cymose.

16. Pistillate flowers in 3's, substipitate or shortly (1.75 mm long) pedicellate; interior of staminate corolla sparsely puberulous near base. 8. *D. triflora.*

16. Pistillate flowers solitary, sessile; interior of staminate corolla glabrous.

17. Ovary glabrous; mature fruit long stipitate to 7–8 mm; staminate calyx 5–8 mm long, hirsutulous to strigose in lower half; leaves usually 4- (rarely 3-) verticillate. 9. *D. fusifera.*

17. Ovary sparsely puberulous in lower portion; mature fruit shortly stipitate to 2.5 mm; staminate calyx 4–5.5 mm long, sparsely puberulous to strigose near base; leaves usually 3- (rarely 4-) verticillate. 10. *D. sprucei.*

11. Leaves glabrous throughout.

18. Leaves mainly or wholly opposite.

19. Fruit densely hirsute; hypanthium of pistillate flower densely hirsute; pedicels of staminate flowers hirsute; pedicels of staminate flowers much abbreviated, subsessile to 4 mm long. 4. *D. eriopila.*

19. Fruit glabrous; hypanthium of pistillate flower glabrous; pedicels of staminate flowers glabrous to strigose; pedicels of staminate flowers more conspicuous and elongated, (1.5–)5–11 mm long.

20. Interior of staminate corolla-tube wholly glabrous; corolla-lobes of staminate corolla 5. 11. *D. gransabanensis.*

20. Interior of staminate corolla-tube minutely puberulent or pilosulous near base; corolla-lobes of staminate corolla 6–8.

21. Calyx of staminate flowers shortly campanulate, 4–4.5 long, uniformly sericeous for 2/3 the length; pedicels of staminate flowers strigose; lateral pairs of nerves of leaf-blades 10–14; tertiary venation on upper leaf-

surface not conspicuous; staminate corolla-lobes 6; staminate corolla 20–22 mm long, the tube 10–11 mm long. 12. *D. paruensis.*

21. Calyx of staminate flowers deeply campanulate, 8–9 mm long, chiefly glabrous or sparsely strigillose on part of surface; pedicels of staminate flowers glabrous; lateral pairs of nerves of leaf-blades 6–9; tertiary venation on upper leaf-surface subprominulous; staminate corolla-lobes 7–8; staminate corolla 26–35 mm long, the tube 15–20 mm long. 13. *D. bolivarensis.*

18. Leaves chiefly 3–4-verticillate.

22. Pistillate flowers in 3's, on elongated pedicels; peduncles of staminate inflorescences more or less evident and elongate, 1–4.5 cm long.

23. Pedicels of pistillate flowers glabrous; petioles glabrous; peduncles of staminate inflorescences sparsely pilose. 14. *D. genipoides.*

23. Pedicels of pistillate flowers sparsely pilose; petioles sparsely pilose; peduncles of staminate inflorescences glabrous or glabrate. 15. *D. paraensis.*

22. Pistillate flowers solitary, sessile; peduncles of staminate inflorescences none or greatly reduced, 0.4 cm or less long, the flowers thus fasciculately or umbellately arranged.

24. Calyx of staminate flowers deeply campanulate to tubular, 8–11 mm long. 16. *D. merumensis.*

24. Calyx of staminate flowers campanulate, 3–6 mm long.

25. Leaf-blades narrowly oblanceolate to oblong-spathulate, 8.5–16 cm long, 2–3.5(–4.5) cm broad; petiole 0.7–1.5 cm long; pubescence of staminate calyx externally interrupted by glabrate zones. 17. *D. nitida.*

25. Leaf-blades broadly elliptic to oblong-obovate to elliptic-oblanceolate, 14–24 cm long, 5–12 cm broad; petiole 1.5–4 cm long; pubescence of staminate calyx externally not interrupted.

26. Corolla-tube of staminate corolla externally densely retrorsely strigose-sericeous; staminate calyx deeply campanulate, 5–6 mm long, gray-puberulent in lower half with minute short appressed hairs. 18. *D. retrorsipila.*

26. Corolla-tube of staminate corolla externally upwardly strigose-sericeous; staminate calyx shallowly campanulate, 3–4.8 mm long, densely buff-sericeous or strigose over most of surface. 19. *D. longiflora.*

1. **Duroia hirsuta** (P. & E.) Schum. in Mart. Fl. Bras. **6**(6): 367. 1889.

Amaioua hirsuta P. & E. Nov. Gen. & Sp. 3: 25. *pl. 230.* 1845, type: without locality, Peru (probably Dept. Loreto), *Poeppig 2823* (photo of type from Delessert herb., NY).

Distribution. Amazonian Brazil (Estado Amazonas and Territorio Acre), Colombia (Intendencia Meta), Peru (Dept. Loreto), and Ecuador (Prov. Santiago-Zamora).

The elongated hispid calyx-lobes of this species distinguish it from the other species of this genus.

Duroia spraguei Wernh. (Kew Bull. **1914**: 66. 1914), described from Mocoa, Caquetá District, Colombia, collected by *Sprague 369,* apparently is conspecific with *D. hirsuta.* From the description and photograph of the type, it seems to represent a pistillate plant of *D. hirsuta.* Although stated to differ from *D. hir-*

suta in having solitary flowers, the solitary flower is characteristic of the pistillate plant of *D. hirsuta,* while the many flowered branching type is characteristic of the staminate plant. The densely long sericeous, very hispid ovary described for *D. spraguei* is likewise encountered in *D. hirsuta,* as are the subulate-setaceous sericeous-hispid calyx-lobes.

2. **Duroia kotchubaeoides** Steyermark, sp. nov. Fig. 30, E–G.

Arbor 8-metralis, ramis glabris; stipulis terminalibus 2.5–3 cm longis ferrugineo-strigosis; foliis ad apices ramorum aggregatis, 4-verticillatis petiolatis, petiolis 12–17 mm longis utrinque strigosis; laminis ovali-oblongis vel late oblongis apice rotundatis 6.5–9.5 cm longis 3.5–5.5 cm latis supra glabris costa media strigillosa excepta subtus glabris costa media strigillosa excepta, nervis lateralibus utroque latere 6–7; floribus masculinis terminalibus umbellatis 5–6 epedunculatis; pedicellis 2–3 cm longis dense strigillosis; calyce masculino campanulato apice truncato interdum 1–2-denticulato 5.5–6 mm longo 6–8 mm lato extus dense strigilloso intus sericeo; corolla masculina 28 mm longa, lobis tubum longioribus, tubo 10 mm longo 6 mm lato extus dense strigoso intus parte basali 3 mm glabra supra antheras 7 mm dense strigosis, lobis 8 lanceolato-oblongis obtusis 17–18 mm longis 6–7.5 mm latis utrinque dense pulverulentibus; antheris 8 supra basin tubi corollae 5.5 mm insertis 6.5 mm longis cum appendiculum 0.5 mm.

Type. Arbol 8 m; flores blancas; Caño Tama-Tama, at alt. 150 m, Río Orinoco, Amazonas, Venezuela, 12 Sep 1954, *J. Silverio Level 147* (holotype NY). Paratype. Río Guainia, Puerto Colombia (opposite Maroa) and vicinity, Lat. 2° 40′ N, Long. 67° 30′ W, Vaupes, Colombia, at alt. 242–250 m, 31 Oct–2 Nov 1952, *Richard Evans Schultes, Richard E. D. Baker & Isodora Cabrera 18211* (US).

This species differs from other members of the genus in the possession of 8 stamens and 8 corolla-lobes, subumbellate terminal epedunculate staminate inflorescence, and the densely strigose upper portion of the corolla-tube within. In its epedunculate subumbellate terminal inflorescence it simulates some species of the genus *Kotchubaea.*

3. **Duroia duckei** Huber, Bull. Soc. Bot. Gen. **6**(2): 205. 1914.

Type. Lac Salgado (Río Cuminá, las Trombetas, Pará, Brazil, 9–12–1906, *A. Ducke 7916* (isotype US).

Distribution. Estado Pará and Amazonas, Brazil, and Amazonian Colombia (Loretoyaco).

Huber cites no collection number in his original description. In the United States National Herbarium the *Ducke 7916* specimen is placed in the type folder collection, and I have taken this specimen as an isotype collection.

4. **Duroia eriopila** L. f. Suppl. Pl. 209. 1781.

Key to the Varieties of *Duroia eriopila*

1. Staminate calyx 6–6.5 mm long, the summit repand-denticulate with minute teeth. var. *brevidentata.*
1. Staminate calyx 3–5.5 mm long, the summit truncate, entire, or subentire.
  2. Leaf-blades glabrous throughout. var. *eriopila* f. *glabra.*
  2. Leaf-blades with pubescence at least on midrib or lateral nerves above or below.
    3. Staminate corolla-tube 15–19 mm long, lobes 14–18 mm long; lateral pairs of nerves of leaf-blades 9–17; tertiary venation of upper leaf-surface usually

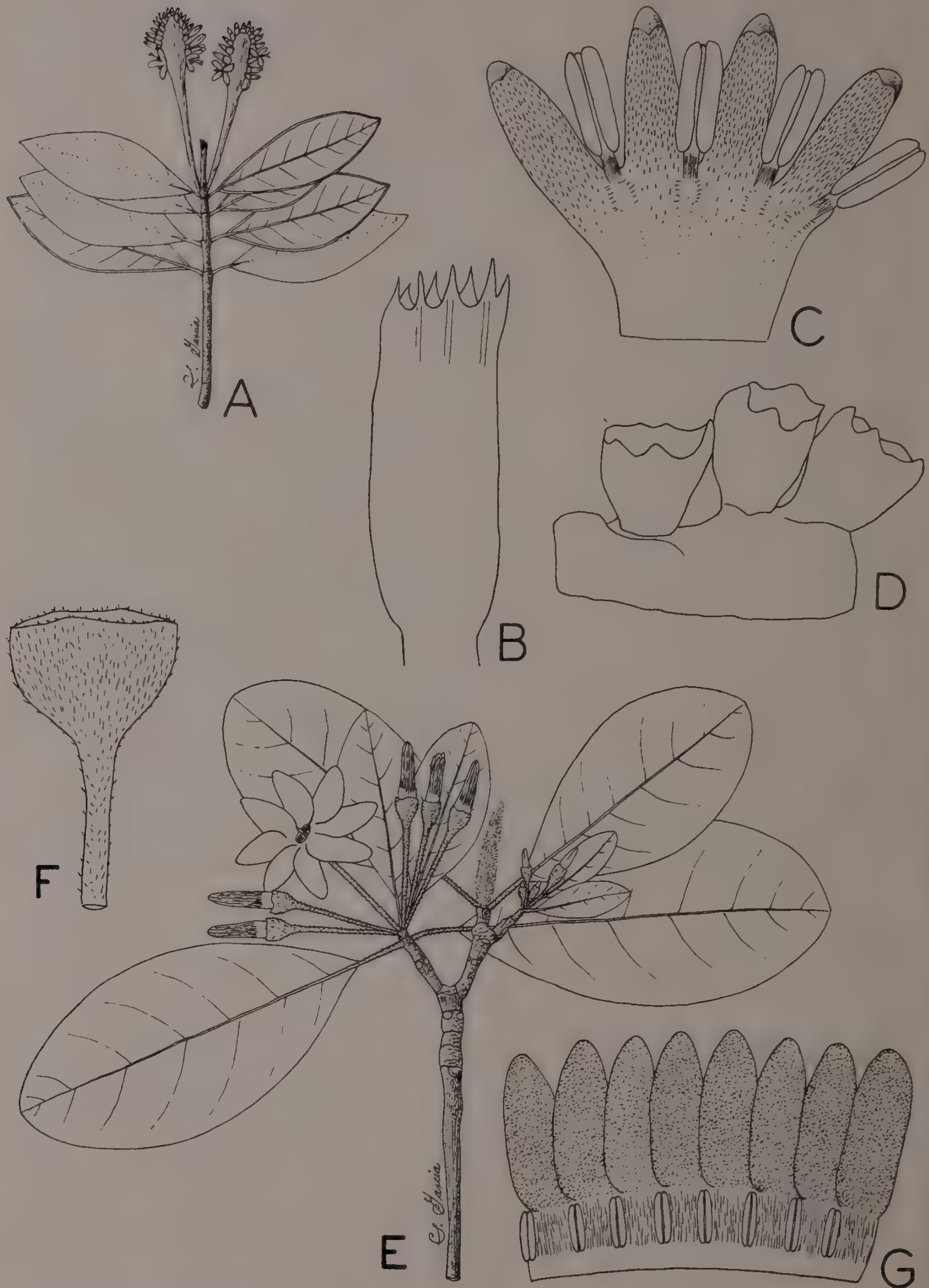

FIG. 30. A–D, *Pagamea diceras*. A, habit of flowering branch, × 1/2. B, stipular sheath, × 10. C, corolla, interior view, × 7, D, portion of rachis with three calyces, × 7. E–G, *Duroia kotchubaeoides*. E, habit of flowering branch, staminate plant, × 1/2. F, staminate calyx with pedicel, × 2. G, staminate corolla, interior view, × 1-1/3.

prominently transversely lineolate; petioles usually moderately or abundantly hirsute; at least the midrib of lower surface of leaf-blade conspicuously hirsute or hispid. var. *eriopila* f. *eriopila.*

3. Staminate corolla-tube 12–13 mm long, lobes 8–10 mm long; lateral pairs of nerves of leaf-blades 8–10; tertiary venation of upper leaf-surface not prominent; petioles glabrate to sparsely hirsute; midrib of lower surface of leaf-blade usually glabrous, the pubescence of sparse hirsute hairs confined to midrib of upper surface. var. *tafelbergensis.*

4a. **Duroia eriopila** L. f. var. **eriopila** f. **eriopila.**

Type. Marmelade doosees boom, Surinam, *Dalberg.*

Amaioua ursina Standl. Field Mus. Publ. Bot. 8: 168. 1930, type: Kamakusa, upper Mazaruni river, Long. about 59° 50′ W, British Guiana, 11–22 Jul 1923, *J. S. de La Cruz 4169* (F, US).

Genipa merianae A. Rich. Act. Soc. Hist. Nat. Paris 1: 107. 1792.

Duroia surinamensis (Steud.) Jackson & Hook. f. Index Kew 1: 804. 1893, type: Caselbur Pas., Surinam, *Hostman 1187* (K, photo NY).

Amaioua surinamensis Steud. Flora 26: 763. 1843.

Distribution. Suriname, British Guiana, Venezuela, and Amazonian Basin of Brazil.

4a′. **Duroia eriopila** var. **eriopila** f. **glabra** Steyermark, f. nov.

A var. *eriopila* laminis foliorum utrinque glabris recedit.

Type. Tree 25 m high; on high land, basin of Essequibo river, near mouth of Onoro Creek, lat. about 1° 35′ N, British Guiana, 15–24 Dec 1937, *A. C. Smith 2792* (holotype NY).

4b. **Duroia eriopila** var. **tafelbergensis** Steyermark, var. nov.

Arbor 5–12-metralis; petiolis glabris vel sparse hirsutis; laminis foliorum glabris vel costa media supra hirsuta; nervis lateralibus utroque latere 8–10; tubo corollae masculinae 12–13 mm longo.

Type. Tree to 10 m high, 15 cm diam; corolla lobes cream-white, tube white; medium forest between Savannas 4 and 5, Tafelberg, Suriname, at alt. 535 m, 16 Aug 1944, *Bassett Maguire 24393* (holotype NY). Paratypes. SURINAME. Tafelberg, south rim Arrowhead Basin at alt. 640 m, *Maguire 24646;* Tafelberg, mixed wallaba forest, km 23 at alt. 150 m, *Maguire 24819;* Tafelberg, Kappelsavanna at alt. 300 m, *Kramer & Hekking 3066.*

4c. **Duroia eriopila** var. **brevidentata** Steyermark, var. nov.

A var. *eriopila* differt calyce florum masculorum 6–6.5 mm longo dentibus brevibus 0.1–0.2 mm longis et corollis masculis minoribus tubo 10 mm longo lobis 11.5–12 mm longis.

Type. Arbor parva; floribus albis; silva sub montis radicibus, Serra Grande, Rio Branco, Amazonas, Brazil, 31 Aug 1943, *A. Ducke 1332* (staminate plant, holotype NY). Paratype. Same locality and date, *Ducke 1333* (pistillate plant, NY).

Except for the short calyx-teeth of the staminate flowers and the smaller staminate corollas, this variety in all other respects is similar to var. *eriopila* f. *eriopila.*

5. **Duroia strigosa** Steyermark, sp. nov.

Arbuscula, ramis juvenilibus vel terminalibus sparse strigosis vel glabrescentibus; foliis petiolatis, petiolis 17–22 mm longis strigosis; laminis oppositis cum *D. eriopila* similibus, utrinque sparse tenuiterque strigillosis, subtus costa media plus minusve strigosa, nervulis tertiariis subtus prominulis, nervis lateralibus utroque latere 9–11 strigosis; pedicellis masculis 5–7 mm longis sericeis; floribus masculis epedunculatis; tubo calycis florum masculorum profunde campanulato 6–8 mm longo apice 6.5–7 mm lato extus sericeo intus sericeo; corolla mascula 28–32 mm longa, tubo hypocrateriformi 15.5–17.5 mm longo basi 3.5 mm lato fauce 6–6.5 mm lato extus dense tomentello intus parte basali 2 mm glabro deinde 4–5 mm sparse piloso deinde apicem versus glabro, lobis 6 oblongo-lanceolatis subacutis 11.5–14 mm longis 3.5–5.5 mm latis utrinque dense cano-tomentello-sericeis; staminibus 6, filamentis 1 mm longis supra basin tubi corollae 11 mm insertis; stylo 11.5 mm longo glabro; stigmatibus 7.5 mm longis.

Type. Small tree; flowers white; infrequent in dry low semi-open woodland on sandstone, Cerro Pitón, Cordillera Epicara, Río Chicanán, Estado Bolivar, Venezuela, at alt. 400 m, 9–11 Sep 1962, *Bassett Maguire, Julian A. Steyermark & Celia K. Maguire 53676* (holotype NY, isotype VEN).

This species differs from *D. eriopila* L. f. in the possession of the deeply campanulate calyx-tube, longer sericeous instead of hirsute pedicels of the staminate flowers, strigose petioles, and strigose to subglabrate apical branches.

6. **Duroia palustris** Ducke, Notizb. **11**: 480. 1932.

Type. In paludibus ad flumen Tonantins, affluentem fluvii Solimoes, Amazonas, Brazil, 15 Nov 1926, *A. Ducke 22891* (holotype RB, isotype US).

This species shows affinity with *D. eriopila* L. f. in the long ferruginous pubescence of the calyx-tube and petioles.

7. **Duroia petiolaris** Hook. f. ex Schum. in Mart. Fl. Bras. **6**(6): 364. 1889.

Amaioua petiolaris Spruce ex Benth. & Hook. Gen. Pl. **2**: 82. 1873, nomen.

Type. Prope Panure ad Río Vaupés, Brazil, Oct 1852–Jan 1853, *R. Spruce 2888* (holotype K, isotype NY).

Distribution. Amazonian Brazil and Colombia. *Schultes 7127* from Loretoyacu river, Trapecio Amazonico, Colombia is referable to this species.

8. **Duroia triflora** Ducke, Archiv. Jard. Bot. Rio Janeiro **4**: 183. 1925.

Type. Margen pedregosa do rio, Rio Tapajoz, São Paulo, Pará, Brazil, 4–XII–1919, *A. Ducke 15561* (pistillate plant, holotype RB, 2 sheets, 1 in flower, the other in fruit). Paratypes. Rio Tapajoz, Goyana, Pará, 16–10–1922, *Ducke 17420* (staminate plant, RB); Rio Tapajoz, Acará, 3–8–1923, *Ducke 17421* (staminate plant, RB).

Distribution. Known only from the Rio Tapajoz and Rio Solimoes (*Krukoff 8922*), Amazonian Brazil.

9. **Duroia fusifera** Hook. f. ex Schum. in Mart. Fl. Bras. **6**(6): 363. 1889.

Amaiou fusifera Spruce ex Benth. & Hook. Gen. Pl. **2**: 82. 1873, nomen.

Type. Ad flumina Casiquiari, Vasiva et Pacimoni, Amazonas, Venezuela, 1853–4, *R. Spruce 3405* (holotype K, isotype NY).

Distribution. A small-sized riverine tree principally of the upper Rio Negro-Río Guainía and Orinoco river drainage of Venezuela and Colombia.

The description of the fruit is based upon an immature fruiting specimen with stipitate fruit. The photo of the holotype specimen from Kew shows stipitate young fruits but they are not truly mature. The young fruits are acutely narrowed to the base and stipitate 10–12 mm. As the fruit matures the stipe becomes shorter and the fruit then appears almost sessile or subsessile. In the isotype specimen seen at NY the leaves are 4-verticillate, oblong to broadly oblong and rounded at apex, glabrous, and with 8–9 nerves on each side of the midrib. There is no indication of prominent transverse venation on the upper surface, as is found in *D. genipoides*. The photo of the holotype at Kew shows the oblong leaves rounded at the base as in the isotype specimen at NY.

The specimen of *Williams 14374* has young fruits with stipes 8–15 mm long and the young fruits, 3.5 cm long, 2.8 cm wide, are about at the same stage of development as those described in the *Spruce* specimen of *D. fusifera*. At first the young fruits are pubescent, but later become glabrous.

In the specimen of *Cuatrecasas 7031* from bocas del Carurú, Vaupes, Colombia, the calyx of the staminate flower is prominently repand-denticulate.

10. **Duroia sprucei** Rusby, Descr. N. Sp. S. Amer. Pl. 133. 1920.

> *Coupoui micrantha* James Ladbrook, Jour. Bot. **58**: 176. 1920, type: French Guiana, *Martin* (BM).

Type. Sacupano, Delta Amacuro, Venezuela, Apr 1896, *H. H. Rusby & Roy W. Squires 172* (holotype NY, isotypes F, US). Syntype. Sacupano, *Rusby & Squires 171* (NY).

Distribution. A small- to medium-sized tree bordering lake and river margins in the Orinoco drainage of Venezuela, upper Río Negro and Amazonian drainage of Colombia, Brazil, and Peru. A single collection, *A. C. Smith 2237* from Karenambo, basin of Rupununi river, British Guiana, is also referable to this species.

The staminate flowers, as judged by the specimen of *Aristeguieta 4571* from estado Guarico, Venezuela, are shortly pedunculate and, in this respect, similar to those of *D. fusifera*. The only collection thus far seen with pistillate flowers is *Aristeguieta 4572*. In this collection the pistillate flowers are sessile or subsessile with only a short stipe present. The fruits, while mainly sessile or subsessile, show variation in this respect in different stages of maturity. The leaves vary considerably and, although usually 3-verticillate, may be 4-verticillate. The shape of the fruit varies from oblong-elliptic or elliptic-oblong to ovoid-subglobose, and, as it matures, becomes less stipitate as in *D. fusifera*.

Pending future collections showing the pistillate flower stipe in all stages of development, this taxon is retained in the specific category. It may eventually have to be merged with *D. fusifera*.

11. **Duroia gransabanensis** Steyermark, sp. nov.

Arbor 8-metralis, foliis oppositis vel interdum ternatis petiolatis, petiolis 2–4 cm longis glabris; laminis late oblongis vel elliptico-oblongis apice rotundatis vel obtusis basi cuneatim angustatis 15–22 cm longis 7.5–11 cm latis utrinque glabris, nervulis tertiariis supra non prominentibus; nervis lateralibus utroque latere 6–9; inflorescentia mascula fere sessili, pedunculis 1–2 mm longis strigosis prope basin ramosis; pedicellis 1.5–7 mm longis strigosis; calyce masculo campanulato

6–7 mm longo 5.5–6 mm lato extus pro longitudini 2/3 sericeo intus sericeo; tubo corollae masculae 10–10.5 mm longo 5.5–6 mm lato extus retrorse dense strigoso intus glabro, lobis 5 oblongo-lanceolatis acutis 9 mm longis 4 mm latis utrinque puberulentibus; antheris 5, 8 mm longis cum appendiculo 0.5 mm longo; fructu solitario sessili oblongo apice rotundato basi subobtuso 6 cm longo 4 cm lato glabro.

Type. Orillas de selvas de galeria, Uari, Gran Sabana, Estado Bolívar, Venezuela, 15 Mar 1946, *F. Tamayo 3133* (holotype VEN). Paratype. En el borde de la selva Kavanayén, quebrada selvas y sabana de Mandapai, Bolívar, 28 May 1946, *Lasser 1809* (VEN).

12. **Duroia paruensis** Steyermark, sp. nov.

Arbor 6-metralis, foliis oppositis petiolatis, petiolis 3–4 cm longis glabris; laminis late oblongo-ellipticis apice abrupte obtuse breviacuminatis basi subacutis vel angustatis 20–26 cm longis 10–16 cm latis utrinque glabris, nervulis tertiariis supra subprominente transversis; nervis lateralibus utroque latere 10–14; inflorescentiis masculis umbellatis epedunculatis, pedicellis 5–8 mm longis sparse adpresso-pilosis; calyce masculo campanulato 4–4.5 mm longo 4–5 mm lato apice truncato vel subrepando extus supra medium glabrato ceterum breviter sericeo intus sericeo; tubo corollae masculae 10–11 mm longo 5–6 mm lato extus retrorse dense strigoso intus glabro supra basin 2 mm pubescenti excepto, lobis 6 ovato-lanceolatis acutis 10–11.5 mm longis 5–6 mm latis; antheris 6, 7 mm longis; fructu subgloboso-ovoideo apice basique rotundato 5 cm longo 4.3 cm lato glabro.

Type. Tree 6 m; flowers white; occasional in slope forest, Serrania Parú, Amazonas, Venezuela, 13 Feb 1951, *R. Cowan & J. Wurdack 31447* (holotype NY). Paratype. Río Apaporis, Soratama (above mouth of Río Kananarí) and vicinity, lat. 0° 5′ N, long. 70° 40′ W, Amazonas-Vaupés, Colombia, at alt. ca. 272 m, 18 Mar 1952, *R. E. Schultes & Isidoro Cabrera 15979* (US).

13. **Duroia bolivarensis** Steyermark, sp. nov.

Arbor 4–9-metralis parce ramosa, foliis oppositis petiolatis, petiolis 1.5–3 cm longis glabris; laminis elliptico-oblongis apice obtusis vel obtuse acutis basi acutis 21–31 cm longis 9–20 cm latis utrinque glabris, nervulis tertiariis supra subprominentibus; inflorescentiis masculis fere sessilibus fere subumbellatis, pedunculis brevibus 3–5 mm longs glabris; pedicellis 6–11 mm longis glabris; calyce masculo profunde campanulato 8–9 mm longo 6–6.5 mm lato extus glabro intus dense sericeo apice truncato vel denticulato cum appendicibus 0.1–0.2 mm longis; tubo corollae masculae 15–20 mm longo 6–7.5 mm lato extus retrorse dense strigoso intus glabro supra basin 3 mm pubescenti excepto, lobis 7–8 anguste lanceolatis falcato-acutis vel subacutis 11–15 mm longis 2.5–4 mm latis utrinque dense velutinis; antheris 8, 12–12.5 mm longis cum appendiculo 0.6–0.75 mm longo; fructu solitario terminali sessili glabro 5–7.5 cm longo 3.5–7 cm lato.

Type. Orillas del Río Tonoro, alto Río Paragua, Estado Bolívar, Venezuela, 2–15 Aug 1943, *F. Cardona 819* (holotype VEN, isotype F). Paratypes. VENEZUELA. Rich woods bordering quebradas at base of south-facing slopes, Ptari-tepui, at alt. 1585–1600 m, *Steyermark 60027;* southwestern-facing forested steep slopes, above valley of Río Tirica, Chimantá-tepui (Torono-tepui), at alt. 1000–1400 m, *Steyermark 75393;* high montane forest, summit of southerly portion of Cerro Uroi, alto Río Uroi, at alt. 1000 m, *Maguire, Steyermark & Maguire 53872.*

14. Duroia genipoides Hooker f. ex Schumann in Martius, Fl. Brasil. **6**(6): 364. 1889.

Amaioua genipoides Spruce ex Benth. & Hook. Gen. Pl. **2**: 82. 1873. nomen.

Type. In camporum marginibus, Maipures, Amazonas, Venezuela, Jun 1854, *R. Spruce 3634* (K, photo NY).

Distribution. VENEZUELA. Maipures, *Spruce 3634* (holotype K, photo NY); Orinoco, Puerto Zamuro, *Gaillard 19;* Puerto Ayacucho, *Holt & Blake 809;* Isla Carestia at Saltos Carestia y Gallo, 5 km N of Sanariapo, *Maguire, Wurdack & Bunting 36173.* BRAZIL. Boca del Rio Castanho, raudales Uayanari, Rio Padauari, Brazil-Venezuela border, *Cardona 1262.*

Many collections identified as *D. genipoides* prove to be *D. fusifera, D. sprucei,* or other taxa. A recent collection by *Maguire, Wurdack & Bunting 36173* near the type locality is the first pistillate collection since the type, and, with the 3–4 mature fruits on long fruiting pedicels, is an excellent match for the type of *D. genipoides.* The species is rarely collected, and is characterized by the 3–4 long-pedicellate fruits, glabrous pistillate pedicels, ovary, and calyx-tube, and ternate leaves with the upper leaf surface conspicuously transversely veined.

Standley confused this species with *D. sprucei* Rusby. In his Rubiaceae of Venezuela (Bot. Ser. Field Mus. **7**: 395. 1931) he states that *Spruce 3624* is "The same number is the type of D. sprucei." This is misleading because Rusby cites *Rusby & Squires 171* and *172* from Sacupana, lower Orinoco, as constituting the type of *D. sprucei.* Although Rusby made the statement in his publication (Descr. N. Sp. S. Amer. Pl. 133) that "The same as *Spruce 3624,*" this implied that his *D. sprucei* was identical with the taxon represented by *Spruce 3624,* namely *D. genipoides.* As brought out in the current treatment of *Duroia,* I regard the two taxa as different species, *D. genipoides* having prominently long-pedicellate fruits and *D. sprucei* sessile fruits (as described by Rusby under *D. sprucei*).

Incidentally, it should be noted that *Spruce 3634* (not *3624*) is the correct number that should be cited for the type of *D. genipoides.* On the photo of the type from Kew the upper specimen with the label marked "Type collection of Duroia genipoides Hook. f. ex Schum. and of *Duroia sprucei* Rusby" bears the number *3634,* whereas the lower specimen has the label also marked with the number *3634.* Both specimens show 3 stipitate long-pedicellate fruits.

15. Duroia paraensis Ducke, Archiv. Jard. Bot. Rio Janeiro **4**: 182. 1925.

Type. In silva ad ripas sabulosas fluvii Pará prope Mosquerio, Pará, Brazil, 21–1–1923, *A. Ducke 17417* (holotype RB, isotype US, photo from B at F, NY, VEN).

Distribution. Known only from Pará, Amazonas, and Maranhaõ, Brazil.

Eventually, this may prove to be only a variety of *D. genipoides* when more material has been collected.

16. Duroia merumensis Steyermark, sp. nov.

Arbuscula ad 4-metralis, foliis ad apices ramorum 3-verticillatis petiolatis, petiolis 3–5 cm longis glabris; lamins late oblongo-ellipticis apice abrupte obtuse acuminatis vel acutis basi acutate angustatis 17–23 cm longis 7–9.5 cm latis utrinque glabris, nervulis tertiariis supra tenuiter subprominentibus; nervis laterali-

bus utroque latere 7–9; inflorescentiis masculis subimbellatis vel brevipedunculatis; pedunculis 2–3 cum 1–3 floribus, 1–12 mm longis sparse puberulis vel strigillosis; pedicellis 4–13 mm longis brevistrigillosis; calyce masculo profunde campanulato-cylindrico vel tubuloso apice truncato 8–11 mm longo 5–7 mm lato extus dense sericeo-pulverulenti apicem versus glabrato excepto intus sericeo; tubo corollae masculae 13 mm longo 5.5–7 mm lato extus retrorse dense strigoso intus glabro supra medium 2.5–3 mm villosulo 3 mm excepto, lobis 6 late lanceolatis vel ovato-lanceolatis subfalcatis subacutis 13.5–14 mm longis 5–6 mm latis; antheris 6, 9.5–10 mm longis appendiculo fere 1 mm longo instructis.

Type. Small tree to 4 m; petals creamy-white, recurved; infrequent in medium high forest, Upper Mazaruni river basin, Partang River, Merume Mountains, southeast ridge of Merume Mountain, British Guiana, at alt. 1140 m, 6 July 1960, *S. S. Tillett, C. L. Tillett & R. Boyan 44835* (holotype NY).

17. **Duroia nitida** Steyermark, sp. nov.

Arbuscula, ramis terminalibus vel juvenilibus infra apicem turgidis glabris; foliis ut videtur oppositis petiolatis, petiolis 7–10 mm longis glabris; laminis oblanceolatis vel oblongo-spathulatis apice obtusis vel rotundatis raro subacutis vel obtuse acutis basi cuneatim acutis vel subacuminatis 8.5–10(–16) cm longis 2–3.5(–4.5) cm latis utrinque glabris supra nitidis, nervulis tertiariis supra reticulatis; nervis lateralibus utroque latere 6–8; inflorescentiis masculis aggregatis epedunculatis 8–10-floris, pedicellis 2–6 mm longis glabris; calyce masculo campanulato 5 mm longo 4.5–5 mm lato apice truncato extus cano-sericeo in quinque sitibus inter situs glabro intus dense sericeo; corolla mascula immatura 18 mm longa, tubo immaturo 9 mm longo basi 3 mm lato extus dense sericeo parte basali 1.5 mm glabra excepta intus parte basali 1.5 mm glabra deinde 1.5 mm barbato deinde ad faucem glabro, lobis 6 lanceolatis acutis 10 mm longis 3 mm latis; antheris 6 linearibus 5.5–6 mm longis; fructu sessili globroso-ovoideo basi rotundato vel subobtuso 2 cm longo 1.5 cm lato.

Type. Arbor parva; corolla albida; Rio Irubú, Cachoeira Iracema, Amazonas, Brazil, 28–9–1941, *A. Ducke 799* (holotype US, isotype NY). Paratypes. BRAZIL. Upper Rio Negro, São Felippe, Amazonas, *J. T. Baldwin, Jr. 3192* (US); Rio Içana, São Felipe, Amazonas, 16/III/1952, *Froes 27875* (NY); Rio Negro, Vila Içana, capoeira humida, *J. Murca Pires 445* (NY).

18. **Duroia retrorsipila** Steyermark, sp. nov.

Arbor 20-metralis, foliis ternatis petiolatis, petiolis 2.5–4 cm longis glabris; laminis late ellipticis vel oblongo-ellipticis utrinque sensim angustatis 15–24 cm longis 6–10 cm latis utrinque glabris, nervulis tertiariis supra prominentibus; nervis lateralibus utroque latere 8–11; inflorescentiis masculis subumbellatis vel fasciculatis densifloris epedunculatis, pedicellis 4–12 mm longis cano-pulverulentibus; calyce masculo profunde campanulato 5–6 mm longo 4–6 mm lato apice truncato extus inferne ad medium cano-pulverulenti pilis minutis adpressis praedito intus minute sericeo; tubo corollae masculae immaturo 7–8 mm longo extus retrorse dense strigoso intus glabro supra basin 1.5–2 mm strigoso, lobis 6 immaturis 11 mm longis 4 mm latis utrinque dense pulverulentibus; antheris 6, 9 mm longis cum appendiculo 0.5 mm longo instructis.

Type. Tree 20 m tall; vicinity of Cerro Uei, vicinity of road campamento 125, between Luepa and Cerro Venamo, Estado Bolívar, Venezuela, at alt. 1100 m, 20–22 Apr 1960, *Julian A. Steyermark & Sven Nilsson 382* (holotype VEN).

19. Duroia longiflora Ducke, Archiv. Jard. Bot. Rio Janeiro **4**: 181. 1925.

Type. In silvis primariis humosis non inundatis prope oppidum Breves aestuario amazonico, Pará, Brazil, 21–11–1922, *A. Ducke 17148* (holotype RIO, isotype US).

Distribution. BRITISH GUIANA. Moraballi Creek, Essequibo River, *Forest Dept. Field No. F1302;* Mazaruni Station, *Forest Dept. Field No. F1973*. SURINAME. Komaramara Djamaro, Zanderij I, *Wood Herbarium Surinam 277, 277A;* in montibus, qui dicuntur Nassau, *Lanjouw & Lindeman 2778;* Kwariroman, Zanderij I, *Stahel*. BRAZIL. Prope oppidum Breves aestuario amazonico, Pará, *Ducke 17148* (holotype); silva terris elevatis ultra lacum, Juruty Velho, Pará, *Ducke 22885*.

20. Duroia velutina Hook. f. ex Schum. in Mart. Fl. Bras. **6**(6): 366. 1889.

Amaioua velutina Spruce ex Benth. & Hook. Gen. Pl. **2**: 82. 1873, nomen.

Type. Inter Barra et Barcellos, Nov 1851, *R. Spruce 1910* (holotype K, photo at B, isotype F).

Distribution. VENEZUELA. Isla Macará cerca de la confluencia del Río Paduairi, Rio Negro, 15 Jan 1946, *Cardona 1293* (VEN). BRAZIL. Inter Barra et Barcellos, Amazonas, *Spruce 1910;* infra cataractam minorem, ad ripam in igapó, Manaos, Rio Taruma, *Ducke 625;* praia arenosa, Rio Negro, Tapuruquara, *Pires 239A*.

21. Duroia martiniana (Miers) Brem. Rec. Trav. Bot. Neerl. **31**: 270. 1934.

Coupoui martiniana (Miers) Wernham, Jour. Bot. **58**: 107. 1920.
Cupirana martiniana Miers, S. Am. Apocyn. **17**: 1878, type: Cayenne, *Martin* (BM).

Distribution. Known only from the type specimen in French Guiana.

22. Duroia macrophylla Huber, Bull. Soc. Bot. Geneve **6**(2): 205. 1915.

Coupoui brasiliensis Wernh., Jour. Bot. **58**: 107. 1920, type: region des cataractes inferieures, Rio Tapajoz, Pará, Brazil, 3–1–1918, *A. Ducke 16872* (holotype K, isotype US).

Type. Ad flum. Cuminá-mirim, Brazil, 16 Decembre 1906, *A. Ducke 7970* (holotype MG, isotype NY).

Distribution. Amazonian basin of Brazil.

A specimen of *Ducke 22881* from Obidos, Pará, has calyx-tubes 19–22 mm long with elongated teeth 2–3 mm long and pedicels elongated from 15–34 mm, whereas *Ducke 15570* from Rio Cuminá-mirim, Trombetas, Pará, has the calyx-tubes 11–20 mm long with shorter teeth 0.5–0.75 mm long and pedicels of the staminate flowers 10–18 mm long.

23. Duroia amapana Steyermark, sp. nov.

Arbor 5-metralis, stipulis 3–5 cm longis extus dense villosis intus glabris superne connatis; foliis oppositis petiolatis, petiolis 1–1.5 cm longis 7–8 mm latis dense hirsutulis; foliis grandissimis late obovatis apice abrupte longiacuminatis, acumine 1–1.5 cm longo, basi subacutis vel obtusis 50–55 cm longis 26–28 cm latis, supra sparse pilosulis subtus dense pilosulis, supra costa media strigosa subtus costa media nervis lateralibusque dense cano-hirsutulis, nervis tertiariis subtus transverse conspicuis; nervis lateralibus utroque latere 19–20; inflorescentiis foemineis 1–2-floris, floribus sessilibus; tubo corollae foemineae 9–11 mm longo 8 mm lato extus dense strigoso-hirsutulo intus glabro supra medium sparse piloso excepto, lobis 8 ovatis acuminatis 16 mm longis 7–9 mm latis extus dense cano-sericeis intus dense pulverulentibus; antheris 4 mm longis; stylo 6–7 mm longo, stigmatibus 5 lingulatis acutis intus papillatis 9–10 mm longis; ovario urceolato 15 mm alto 16 mm lato extus dense hirsuto; tubo calycis foeminei subcoriaceo 15–25 mm longo utrinque sericeo 3-lobato, lobis ovato-oblongis subacutis vel obtusiusculis in anthesi 6 mm longis 6 mm latis in fructu ad 20 mm longis 12 mm latis; inflorescentiis masculis fasciculatis 5–6-floris; floribus pedicellatis, pedicellis robustis 5–6 mm longis 2–2.5 mm latis dense hirsutulis; calyco masculo profunde campanulato 10 mm longo apice 6–7 mm lato repando-denticulato, dentibus depresso-late triangularibus apiculatis, extus dense stramineo-strigoso-hirsutulo intus dense cano-sericeo.

Type. Tree 5 m high, 10 cm diam; infrequent in varzea forest, Rio Araguari, Camp 13, 1° 45′ N, 25° W, Territorio Amapa, Brazil, 9 Oct 1961, *J. M. Pires, Wm. Rodrigues & G. C. Irvine 51601* (holotype NY pistillate plant). Paratypes. SURINAME. Sandrij I, 11–21–1934, *Archer 2792* (staminate plant, US); Zanderij I, 1–XII–1919, *Herb. Utrecht 4495* (fruiting collection NY).

A fruiting collection from Brazil (*Irwin & Westra 47186*, southeast of Clevelandia, Rio Oiapoque, Territorio Amapa) may belong here.

This species has similar pubescence and reticulation of the lower leaf surface to that of *D. aquatica* (Aubl.) Brem. It is well-characterized by its combination of 3-lobed calyx-tube and 8 corolla-lobes of the pistillate flower. It has a greater number of lateral nerves of the leaf-blades which are more pubescent below with a prominent tertiary venation and shorter thicker petioles than those of *D. eriopila.*

24. Duroia aquatica (Aubl.) Brem. Rec. Trav. Bot. Neerl. **31**: 270. 1934.

Coupoui aquatica Aubl. Pl. Guian. Suppl. p. 16. *pl. 377.* 1775, excluding fruit.
Cupirana aubletiana Miers, S. Am. Apocyn. p. 15. 1878.

Distribution. French Guiana and Suriname.

25. Duroia saccifera (Mart.) Hook. f. ex Schum. in Mart. Fl. Bras. **6**(6): 362. *pl. 146, fig. 1.* 1889.

Amaioua saccifera Mart. ex R. & S. Syst. Veg. **7**: 91. 1829, type.

Distribution. Amazonian basin of Brazil and upper Río Negro-Río Guainía drainage of Venezuela.

26. Duroia plicata R. Ben. Bull. Mus. Hist. Nat. Paris **6**: 558. 1920.

Type. Environs du camp de Godebert, foret marecageuse, French Guiana, Novembre 1919, *Wachenheim 36* (holotype P).

Distribution. Known only from the type collection.

Excluded Species

Duroia longifolia (Poepp. & Endl.) K. Schum. in Mart. Fl. Bras. **6**(6): 365. 1889.

The application of this name is problematical. As all the species of *Duroia* possess a densely sericeous or strigose outer surface of the corolla-tube, the original description of *Amaioua longifolia* P. & E., basionym of *Duroia longifolia,* stating the corollas to be ''glabris,'' would eliminate the taxon from the genus *Duroia.* The elongated calyx-lobes and fuscous-ferruginous calyx might apply to *Alibertia hispida* Ducke (*Duroia stenophylla* Standl.). Of the two specimens (*Krukoff 6861* and *8960* in NY) labeled by Standley as *D. longifolia,* only the staminate collection (*Krukoff 6861*) can be considered conspecific with a photograph of the type, but this has persistent separate stipules, not calyptrate or united as in *Duroia.* The other collection (*Krukoff 8960*) from a pistillate fruiting specimen is not conspecific with that of *Krukoff 6861* and must be referred to still another taxon, whose identity at present is not certain.

Duroia oocarpa Standl. Field Mus. Publ. Bot. **7**: 395. 1931.

Type. In sylvis umbrosis fluminis Guainiae, Venezuela, June, 1854, *R. Spruce 3515* (holotype K).

Duroia stenophylla Standl. Field Mus. Publ. Bot. **8**: 353. 1936. = **Alibertia hispida** Ducke (*Duroia longifolia* ?).

Duroia steinbachii Standl. Field Mus. Publ. Bot. **7**: 290. 1931.

The persistent, small, non-calyptrate stipules exclude this taxon from *Duroia.*

Duroia trichocarpa Standl. Field Mus. Publ. Bot. **8**: 353. 1931.

Although it is not possible at the present time to place this taxon, it must be excluded from *Duroia* because of the 1–2-seeded fruit having each seed enveloped in a loose testa, characters at variance with the genus *Duroia.*

Amaioua Aublet, Hist. Pl. Guiane Fr. Suppl. 13. 1775.

Type species. *A. guianensis* Aublet.

Dioecious flowers are characteristic of this genus of the tribe Gardenieae, as they are also in *Alibertia, Duroia, Stachyarrhena,* and *Kotchubaea.* A number of species originally described in *Amaioua* have later been found to be congeneric with *Duroia* and *Alibertia,* to which genera they are now relegated. Relatively few species of those originally described remain within the genus *Amaioua.* The following treatment refers to those species found in Venezuela and adjacent areas, especially.

Key to the Species of *Amaioua*

1. Calyx-teeth of both staminate and pistillate flowers usually none or rarely up to 0.75–1 mm long; staminate and pistillate inflorescences epedunculate, fasciculate; found at altitudes of 1200–1800 m. 4. *A. brevidentata.*

1. Calyx-teeth of both staminate and pistillate flowers generally 1–4.5 (rarely 0.5–1) mm long; staminate and pistillate inflorescences short- or long-pedunculate, sometimes epedunculate in staminate plants of southern Brazil; found at altitudes of 50–900 m.
    2. Fruits sessile, 12–15 mm diam; pedicels and peduncles of pistillate flowers lacking; peduncles of staminate inflorescences 0–1.1 (rarely 2) cm long; corolla-tube of pistillate flowers 4–5 mm long; lateral nerves of leaf-blades 8–16; barbate hairs usually not present in axils of nerves of lower side of leaves. 3. *A. guianensis.*

2. Fruits pedicellate or borne on a pedunculate inflorescence, 7–11 mm diam; pedicels of some pistillate flowers or fruits 1–22 mm long, rarely lacking; peduncles of staminate inflorescence generally 0.8–5 cm long, rarely 0–0.5 cm; corolla-tube of pistillate flowers 6–9 mm long; lateral nerves of leaf-blades mostly 5–9 (rarely 10–12); barbate hairs often present in axils of nerves of lower side of leaves.
   3. Leaf-blades mainly 4.5–10.5 cm wide, generally 2-1/2–2-3/4 (rarely 1-1/2) times as long as broad; pistillate inflorescence usually pedunculate, the peduncle sometimes up to 3.5 cm long, sometimes absent; pedicels of pistillate flowers up to 1 mm long, sometimes 0; calyx-teeth in pistillate flowers 0.5–1.5 mm long; corolla-tube of pistillate flowers 6–7 mm long; corolla-lobes of staminate flowers 1–2 mm wide; fruiting pedicels 0–5 mm long. 1. *A. corymbosa.*
   3. Leaf-blades mainly 1.5–4(–7.5) cm wide, generally 2-3/4–3-3/4 (rarely 2) times as long as broad; pistillate inflorescence epedunculate, the flowers fasciculate; pedicels of pistillate flowers 5–12 mm long; calyx-teeth in pistillate flowers 1.5–5 mm long; corolla-tube of pistillate flowers 8–9 mm long; corolla-lobes of staminate flowers 2–3.5 mm wide; fruiting pedicels usually 3–22 (rarely less than 3) mm long. 2. *A. intermedia.*

1. **Amaioua corymbosa** H. B. K. Nov. Gen. & Sp. **3**: 419. *pl. 294.* 1818. Fig. 31, H–R.

Amaioua peruviana Desf. Mém. Mus. Paris **6**: 16. *pl. 4, f. B.* 1820.

Distribution. Chiapas and Tabasco, Mexico; Guatemala; British Honduras; Honduras; Panama; West Indies (Cuba, Isle of Pines); Trinidad; South America, from Venezuela, Colombia, British Guiana, to Amazonian Brazil.

This species is the most widespread of all Amaiouas. It is often confused with *A. guianensis,* from which it differs in having 1) a pedunculate pistillate inflorescence, 2) pedunculate fruits, 3) fruits smaller in diameter, 4) fewer-nerved leaf-blades which are frequently barbate in the axils of the nerves on the lower side, 5) more elongated peduncles of the staminate inflorescence, 6) more slender staminate corolla and calyx-tube, 7) longer tube of the pistillate corolla, and 8) narrower corolla-lobes of the pistillate corolla.

2. **Amaioua intermedia** Mart. in Schult. Syst. Veg. **7**(1): 90. 1829.

Key to the Varieties of *Amaioua intermedia*

1. Flowers sessile or subsessile, subcapitate, peduncle none; pedicels of staminate flowers 1–2 mm long. var. *intermedia.*
1. Flowers of staminate inflorescences on usually manifest peduncles and pedicels, the staminate peduncles obsolete or up to 3 cm long; pedicels of staminate flowers 2–13 mm long. var. *brasiliana.*

2a. **Amaioua intermedia** var. **intermedia.**

Amaioua guianensis var. γ *confertiflora* Schum. in Mart. Fl. Bras. 6(6): 359. 1889, type. In umbrosis circa Bahia (Brazil), 1831, *J. Blanchet 1012* (isotype NY).

Distribution. BRAZIL. Lagetta, San José de Tocantins, Goyaz, *Pohl 2029;* in umbrosis circa Bahia, *Blanchet 1012;* near Tabajaza, upper Machado River region, *Krukoff 1431.*

2b. **Amaioua intermedia** var. **brasiliana** (A. Rich.) Steyermark, stat. nov.

A. brasiliana A. Rich. diss. ex DC. Prodr. **4**: 370. 1830.

A. laureaster Mart. in Flora **24**: Beibl. II: 84. 1841, type: Ad fluvium Tagoahy, prov. Cujabanae et prope San Carlos prov. S. Apuli (Brazil), Oct. et Nov., 1839, *Martius 617* (isotype NY).

A. guianensis var. β *brasiliana* (A. Rich.) Schum. in Martius, Fl. Brasil. **6**(6): 359. 1889.

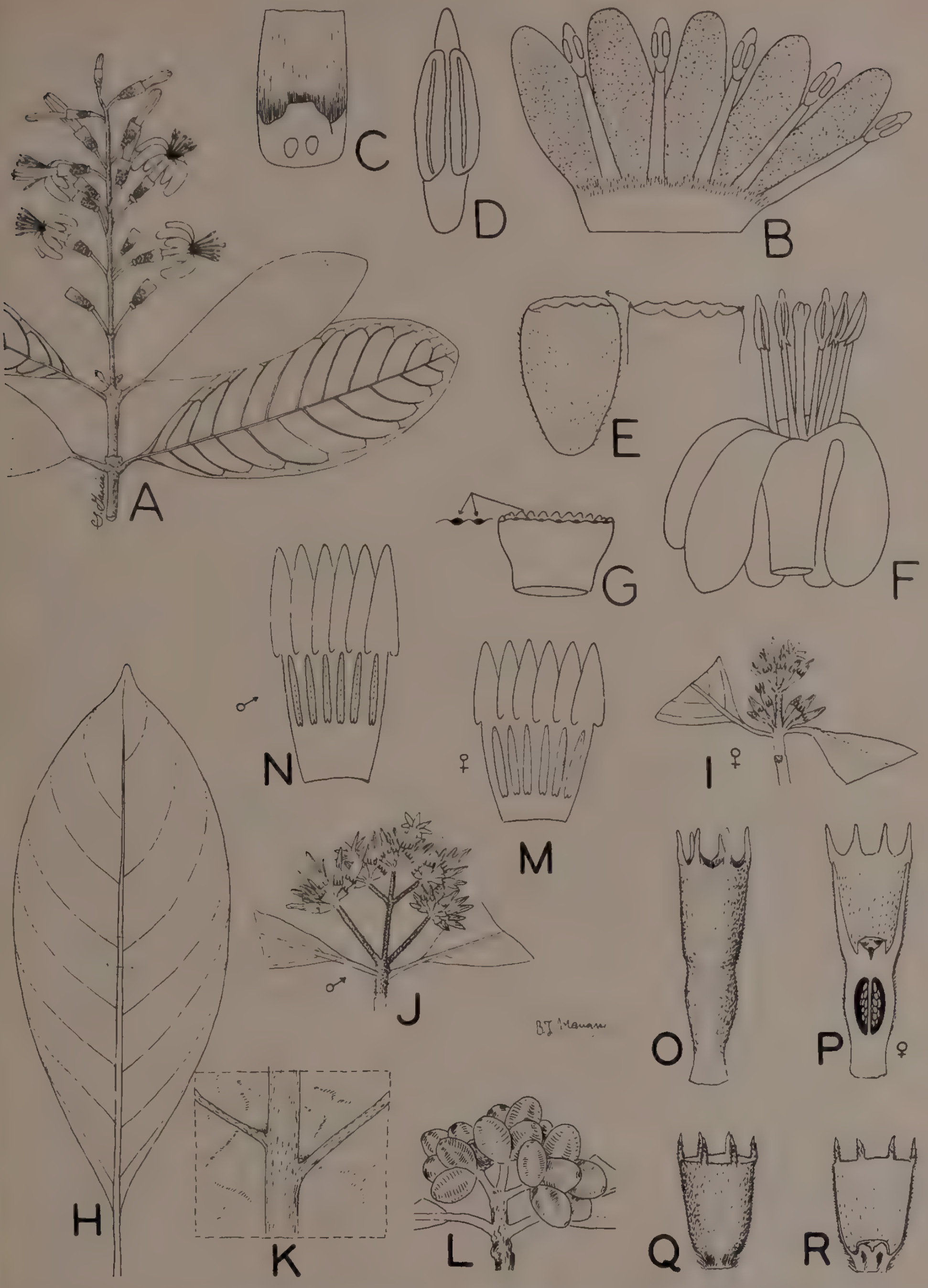

FIG. 31. A–G, *Retiniphyllum tepuiense.* A, habit of flowering branch, × 1/2. B, corolla, interior view, × 2. C, calyx and hypanthium, vertical section, × 4. D, anther, × 9. E, calyx, exterior view, showing repand-denticulate summit, × 4. F, corolla, in natural position, × 2-1/2. G, involucel, showing resinous tubercles at apex, × 15. H–R, *Amaioua corymbosa.* H, leaf, × 1/2, I, pistillate inflorescence, habit, × 1/2. J, staminate inflorescence, habit, × 1/2. K, lower portion of leaf-blade, showing portion of midrib and lateral nerves, × 4. L, fruiting branch, habit, × 1/2. M, pistillate corolla, interior view, × 2. N, staminate corolla, interior view, × 2. O, pistillate calyx and hypanthium, exterior view, × 3. P, vertical section of pistillate calyx and hypanthium, × 3. Q, staminate calyx, exterior view, × 3. R, staminate calyx, vertical section, × 3.

Distribution. Brazil, where commonly encountered in the southern and southeastern part in Minas Gerais, São Paulo, Parana, Santa Catarina, and Rio de Janeiro.

The less common variant, with somewhat more congested inflorescence, described as var. γ *confertiflora* by Schumann, must serve as the nomenclatural type of the species, *A. intermedia*. The commoner var. *brasiliana,* based on *A. brasiliana,* is a later name than *A. intermedia*. Schumann cites the *Martius 617* collection under his var. β *brasiliana*. This collection, upon which *A. laureaster* Mart. was based, is represented at NY by a staminate branch having short peduncles of the inflorescence up to 5 mm long. The photo of the type of *A. laureaster* from K shows a staminate branch on the left hand side of the sheet and a pistillate (fruiting) branch on the right hand side with apparently two pedicellate and fasciculate fruits present.

The *Blanchet 1012* specimen from the Meisner Herbarium deposited at NY is labeled *Amaioua intermedia* and is undoubtedly the collection from Bahia cited by Schumann in Martius's Flora Brasiliensis (p. 359) as var. γ *confertiflora*. It shows the flowers of the staminate and pistillate inflorescences as "conferta" and with "floribus sessilibus."

A. Richard described his *Amaioua brasiliana* as "suffrutescens repens." Such a faulty description of this southern Brazilian species would certainly make the acceptance of the name doubtful. This doubt was expressed by Schumann when he placed the name, prefixed by a question mark, under his synonymy of *A. guianensis*. Whether or not Schumann was using A. Richard's name of *A. brasiliana* in the sense of a new combination in the varietal category, or erecting a new varietal name, var. β *brasiliana,* is debatable. Apparently, he was re-using Richard's name in the varietal category as a new combination, in which sense it is interpreted in the present paper.

Schumann placed this entire complex, treated in the present paper as *A. intermedia,* under *A. guianensis*. However, as presently interpreted, the *A. intermedia* group is more closely related to *A. corymbosa* than to *A. guianensis,* showing relationship to *A. corymbosa* especially in the pedicellate pistillate flowers, pedunculate fruits, frequent occurrence of barbate axils of the nerves on the lower side of the leaf-blades, tendency to more elongated peduncles of the staminate inflorescence, and more generally fewer-nerved leaf-blades.

Treated as somewhat intermediate between *A. corymbosa* and *A. guianensis,* the taxon *A. intermedia* is considered distinct from these other two species in having well-developed fruiting pedicels, fasciculate pistillate flowering and fruiting pedicels, longer pistillate corolla-tube, generally longer pistillate and staminate calyx-teeth, generally longer staminate pedicels, and generally smaller and narrower leaf-blades. In its fasciculate pistillate inflorescence, it approaches *A. brevidentata* Steyermark, described beyond. In its lack of a pistillate peduncle, it shows relationship with *A. guianensis*.

3. **Amaioua guianensis** Aubl. Hist. Pl. Guiane Fr. Suppl. 13. *t. 375*. 1775.

Key to the Varieties of *Amaioua guianensis*

1. Staminate calyx-tube 5–6 mm long; corolla-lobes of staminate corolla 7–12 mm long, tube 9–10 mm long. var. *guianensis.*
1. Staminate calyx-tube 6–9 mm long; corolla-lobes of staminate corolla 13–16 mm long, tube 10–11 mm long. var. *macrantha.*

3a. Amaioua guianensis var. **guianensis.** Fig. 32.

A. fagifolia Desf. in Mem. Mus. Paris **6**: 14. *t. 5.* 1820, type: French Guiana, *Joseph Martin* (P).

Distribution. Venezuela, British, Dutch and French Guiana, Amazonian Brazil, Bolivia, and Amazonian Peru. VENEZUELA. Manoa, Delta Amacuro, *Rusby & Squires 314;* Cerro La Reforma, north of El Palmar, estado Bolívar, *Steyermark 88081, 88083;* Río Toro, estado Bolívar, *Steyermark 88146;* Isla de El Ratón, Amazonas, *Williams 13195.* BRITISH GUIANA. Essequibo River, *Maguire & Fanshawe 22930;* Camoonie Creek, *Persaud 144;* Bartica, *de La Cruz 1918;* Moruka River, *de La Cruz 4532;* Caracara Creek, *Persaud 25;* Waruni-Ituni, *Abraham 130;* Demerara River, *Jenman 4910, Jenman 1707;* Matope-Cuyuni River, *Martyn 249.* SURINAME. Brownsberg, *Zaandam 6930, 6790;*

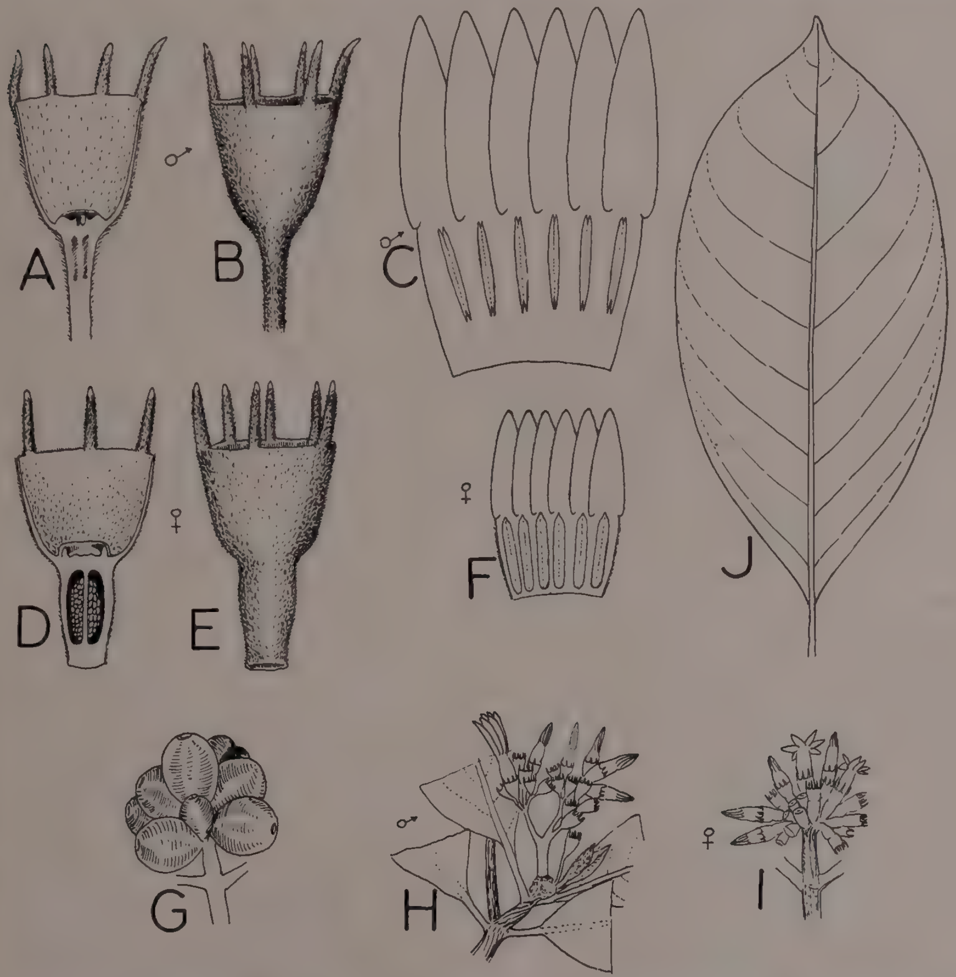

Fig. 32. A–J, *Amaioua guianensis* var. *guianensis.* A, staminate calyx, vertical section, × 3. B, staminate calyx with pedicel, × 3. C, staminate corolla, interior view, × 2. D, pistillate calyx and hypanthium, vertical section, × 3. E, pistillate calyx and hypanthium, exterior view, × 3. F, pistillate corolla, interior view, × 2. G, habit of fruiting branch, × 1/2. H, staminate inflorescence, habit, × 1/2. I, pistillate inflorescence, habit, × 1/2. J, leaf, × 1/2.

Zandery, *Samuels 546.* FRENCH GUIANA. Maroni, *Melinon s. n., 553; Leprieur;* "in sylvis prope amnem Galibiensem" fructum ferebat Maio, photo of type from BG in NY; Acarouany, *Sagot 301.* BRAZIL. Manaos, *Ducke 1179;* prov. Rio Negro, *Spruce 972, 973, 974, 975.* BOLIVIA. Mapiri region, San Carlos, *Buchtien 1723;* Tipuani-Guanai, *Bang 1655.* PERU. Mishuyacu, near Iquitos, *Klug 852;* Balsapuerto, *Killip & Smith 28393.* The Peruvian collections are both atypical, resembling *A. intermedia* var. *intermedia.* The *Killip & Smith 28393* collection has small sessile fruits 10 mm long and 7 mm in diameter. The *Klug 852* collection has a sessile cluster of apparently staminate flowers with short ovate corolla-lobes only 2 mm long and the corolla-tube 4.5–5 mm long, while the leaves are short-petioled (3–5 mm long), only 6–7-nerved, and abundantly pubescent below.

3b. **Amaioua guianensis** var. **macrantha** Steyermark, var. nov.

A var. *guianensis* differt calyce corollaque majoribus, calycis tubo 6–9 mm longo 4.5–5 mm lato; corollae lobis lineari-lanceolatis 13–16 mm longis 1.5–3 mm latis, tubo 10–11 mm longo superne 5–6 mm lato inferne 2–4 mm lato; pedunculis principalibus 0.8–2 cm longis; pedicellis 4–16 mm longis.

Type. Tree 8 m high; flowers white; lowland and slope forests at camp 3, at alt. 700 m, Cerro de la Neblina, Amazonas, Venezuela, 11 Nov 1957, *Bassett Maguire, John J. Wurdack & Celia K. Maguire 42025* (holotype NY). Known only from Neblina.

The leaves in this variety are broadly elliptic, 12–20 cm long by 5.5–10 cm broad, abruptly acuminate at the apex with an acumen 5–10 mm long, acute to obtuse at base, 12–13-nerved, with glabrate surface beneath. The petioles are 1.5–2.5 cm long.

Although Schumann places *A. fagifolia* in synonymy under *A. corymbosa,* it is considered in the present treatment conspecific with *A. guianensis.* Three specimens labeled *A. fagifolia* (*Leprieur; Sagot 301; Melinon*), in the herbaria of P and NY, originating from French Guiana, show contracted subcapitate staminate inflorescences without peduncles, and 7–10-nerved, narrowly elliptic leaf-blades simulating the southern Brazil *A. intermedia* var. *brasiliana.* The illustration of *A. fagifolia* (plate 5 in Mem. Mus. Par.) depicts a broader-leaved plant than shown by the French Guianan specimens cited above, although Desfontaine describes them as "obovatis."

4. **Amaioua brevidentata** Steyermark, sp. nov. Fig. 33, E–N.

Arbor 5–10-metralis, ramis juvenilibus acutate angulatis costatis strigillosis vel glabratis, vetustioribus glabris; stipulis terminalibus solum manifestis ceterum caducis ad 5 cm longis ad 2 cm latis membranaceis dense stramineo-fulvo-sericeis anguste oblongis obtusis; laminis subcoriaceis vel coriaceis late ovatis vel subrotundato-ovatis ad ovato-ellipticis apice abrupte acuminatis basi rotundatis vel subtruncatis ad acutis 8.5–25 cm longis 4.5–16 cm latis supra glabris subtus costa media nervis lateralibusque dense stramineo-sericeis ceterum glabris, nervis lateralibus utroque latere 8–12 subtus elevatis supra impressis; *inflorescentiis masculinis:* pedunculo nullo, floribus masculinis fasciculatis 20–30, pedicellis 9–12 mm longis dense cano-sericeis; calyce hypanthioque 3.5–5 mm longo extus dense sericeo, calyce 3.5–4 mm longo 3–4 mm lato apice truncato, dentibus brevissimis subulatis 0.3–0.5 mm longis; corolla hypocrateri formi-infundibuliformi 12–14 mm longa, tubo 8–8.5 mm longo basi 2.5 mm lato, fauce 4–5 mm lato extus

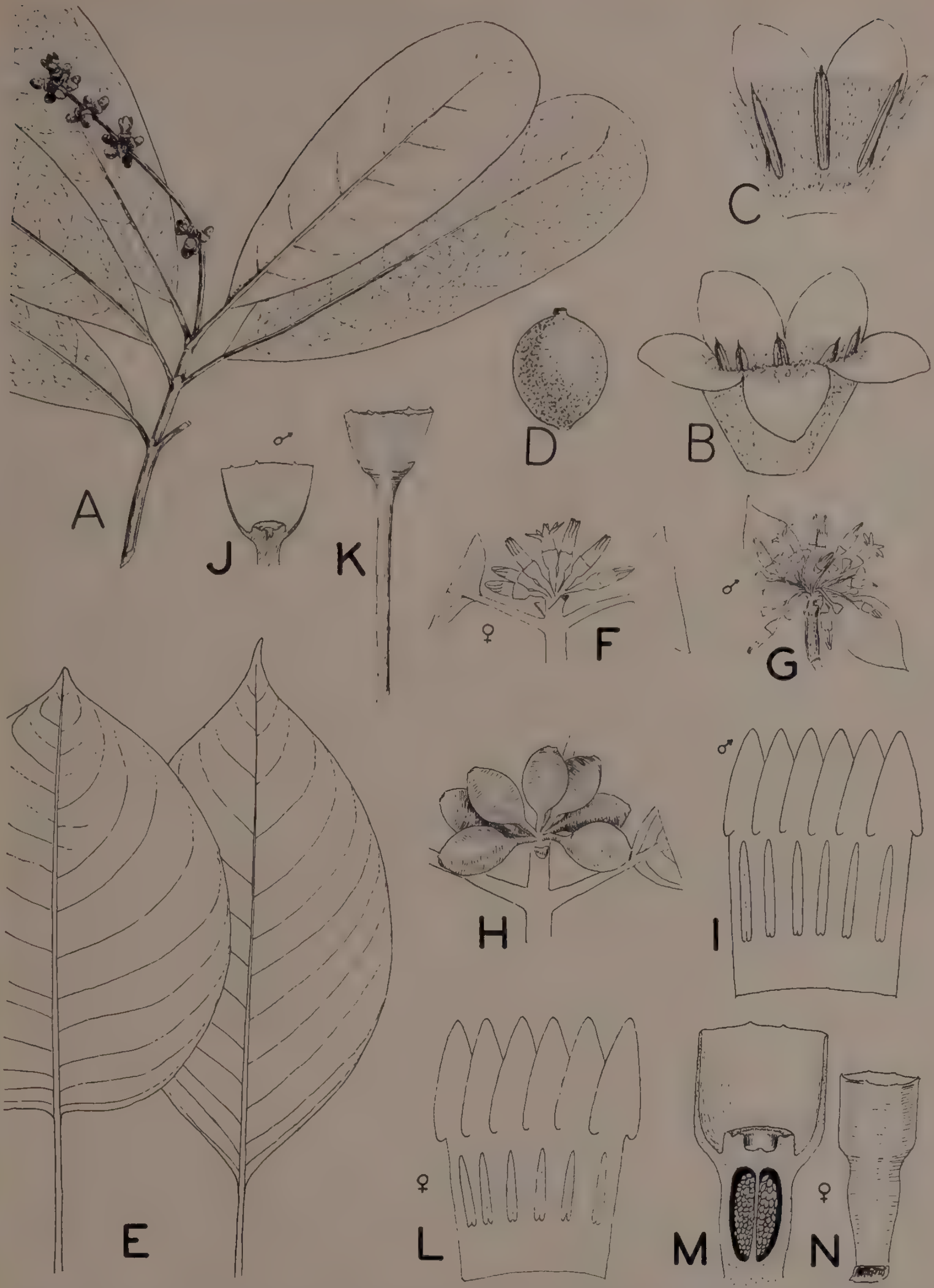

FIG. 33. A–D, *Stachyarrhena reticulata.* A, habit of staminate flowering branch, × 1/2. B, staminate corolla, × 4. C, portion of staminate corolla, interior view, × 4. D, fruit, × 1/2. E–N, *Amaioua brevidentata.* E, leaves of two shapes, × 1/2. F, pistillate inflorescence, × 1/2. G, staminate inflorescence, × 1/2. H, habit of fruiting branch, × 1/2. I, staminate corolla, interior view, × 2. J, staminate calyx, portion of interior view, × 2. K, staminate calyx and pedicel, exterior view, × 2. L, pistillate corolla, interior view, × 2. M, pistillate calyx and hypanthium, vertical section, × 3. N, pistillate calyx and hypanthium, exterior view, × 2.

dense sericeo praeter partem basilarem 1.5 mm longam glabram, intus glabro praeter supra basin 1.5–2 mm puberulam 1.5 mm longam, lobis 6 late lanceolatis vel oblongo-lanceolatis 5.5 mm longis basi 2.3–3 mm latis acutis vel subacutis extus dense cano-sericeo-velutinis intus cano-velutinis; antheris 6 linearibus 4.5 mm longis; *inflorescentiis foemininis:* pedunculo nullo, floribus foemininis fasciculatis 5–9, brevipedicellatis, pedicellis 1.5–3 mm longis dense cano-sericeis; calyce hypanthioque 8–9 mm longo extus in anthesi dense cano-sericeo; hypanthio turbinato 3.5–4 mm longo apice 2.5–3 mm lato; calyce 3–5 mm longo apice 3.5–4.5 mm lato, apice truncato, dentibus nullis vel 6 subulatis 0.5–1 mm longis; corolla cylindrico-infundibuliformi 14–16 mm longa, tubo 8.5–9.5 longo basi 3.25–3.5 mm lato, fauce 4.25–5 mm lato, extus dense sericeo praeter partem basilarem 1.5 mm longam glabram, intus glabro; lobis 6 late oblongo-lanceolatis apice subacutis 6–6.5 mm longis basi 3–4 mm latis, extus minute tomentellis intus tomentellis; antheris 6 linearibus 4–4.25 mm longis; filamentis 1 mm longis; stylo 4.5–6.5 mm longo clavato superne ampliato, stylis lanceolatis acuminatis 4–6 mm longis; baccis oblongo-ovoideis apice rotundatis vel subtruncatis basi subobtusis angustatis 15–20 mm longis 10–12 mm latis, extus primum strigillosis demum parce strigillosis vel glabrescentibus.

Type. Tree 8 m tall; leaves subcoriaceous, deep green with sulcate nerves above, paler green below with raised nerves; corolla white; calyx green; fruit dull maroon-brick-purple; cloud forest on summit of knife-edge ridge above Rancho Grande Biological Station, towards Pico Guacamayo, Parque Nacional Henry Pittier, estado Aragua, Venezuela, at alt. 1500–1700 m, 20 Oct 1961, *Julian A. Steyermark 89802* (holotype VEN). Paratypes. Pico Guacamayo, east of Hotel Rancho Grande, Parque Nacional Henri Pittier, *Little 15426;* alturas de Guacamayo, Parque Nacional Pittier, *Pittier & Nakichenovich 15614;* Fila del Paraiso, Parque Nacional Pittier, *Pittier & Nakichenovich 15460, 15533;* Pico Perriquito, Parque Nacional Pittier, *Little 15449;* Pico Periquito, *Steyermark & Agostini 11;* Alto de Las Vueltas, Parque Nacional Pittier, *Pittier & Nakichenovich 15470;* trail of Cerro Guacamayo, Parque Nacional Pittier, *Steyermark & Agostini 28.*

This species is characterized by the non-pedunculate, fasciculate staminate and pistillate inflorescences, very short calyx-teeth or practically none in the flowers of both sexes, and the leaf-blades much more subtruncate and broadened or even subcordate at the base. This species occurs at the highest altitudes (1200–1800 m above sea level) known for the genus.

Excluded Species

Amaioua affinis Miq. = **Duroia eriopila** L. f.
Amaioua eriopila Baill. = **Duroia eriopila** L. f.
Amaioua fusifera Spruce ex K. Schum. in Mart. Fl. Bras. **6**(6): 363. 1889. = **Duroia fusifera** (Spruce) Hook. f.
Amaioua genipoides Spruce ex K. Schum. in Mart. Fl. Bras. **6**(6): 364. 1889. = **Duroia genipoides** (Spruce) Hook. f.
Amaioua grandifolia Miq. = **Duroia eriopila** L. f.
Amaioua hirsuta Poepp. & Endl. = **Duroia hirsuta** (P. & E.) Schum.
Amaioua longifolia Poepp. & Endl. = **Duroia longifolia** (P. & E.) Schum.
Amaioua occarpa Spruce ex Standl. Field Mus. Bot. Ser. **7**: 395. 1931 in synon. = **Duroia oocarpa** Standl.
Amaioua petiolaris Spruce ex K. Schum. in Mart. Fl. Bras. **6**(6): 364. 1889. = **Duroia petiolaris** (Spruce) Hook. f.

Amaioua saccifera Mart. in Schult. f. Syst. Veg. **7**(1) : 91. 1829. = **Duroia saccifera** (Mart.) Hook. f.

Amaioua surinamensis Steud. Flora **26** : 763. 1843. = **Duroia eriopila** L. f.

Amaioua urophylla Standl. Field Mus. Bot. Ser. **8** : 354. 1931. = **Kotchubaea urophylla** (Standl.) Steyerm.

Amaioua ursina Standl. in Field Mus. Bot. Ser. **8** : 168. 1930. = **Duroia eriopila** L. f.

Amaioua utilis Baill. Bull. Soc. Linn. Paris **1** : 220. 1879. = **Alibertia edulis** (L. Rich.) A. Rich.

Amaioua velutina Spruce in Mart. Fl. Bras. **6**(6) : 365. 1889. = **Duroia velutina** (Spruce) Hook. f.

Stachyarrhena Hook. f. in Hook. Ic. Pl. *t. 1068*. 1870.

This genus is a very distinct member of the tribe Gardenieae, obviously related to other dioecious genera of that tribe, but particularly different from its allied genera in having the staminate flowers in elongated spikes or subspicate inflorescences. Difficulty in identification of the species is due to the incomplete knowledge at present of both sexes, since most of the species are known only from staminate material.

Key to the Species of *Stachyarrhena*

1. Some or all of the staminate flowers pedicellate, the pedicels 0.5–5 mm long.
   2. Staminate calyx ca. 5 mm long, 7 mm broad; some pedicels of staminate flowers up to 5 mm long. *S. pedicellata.*
   2. Staminate calyx 2–2.5 mm long, 3 mm broad; pedicels of staminate flowers 0.5–3 mm long.
      3. Staminate inflorescence erect, together with peduncle, 3–5 cm long; staminate corolla-lobes obtuse; petioles 1–1.5 cm long; leaf-blades with about 15 pairs of lateral nerves, 18–28 cm long, 5–7 cm broad. 1. *S. acuminata.*
      3. Staminate inflorescence pendent, together with the peduncle, 15 cm long; staminate corolla-lobes subfalcately acute; petioles 2–2.7 cm long; leaf-blades with 10–11 pairs of lateral nerves, 14.5–16 cm long, 4.5–5.7 cm broad. 2. *S. acutiloba.*
1. Staminate flowers all sessile.
   4. Staminate inflorescence erect.
      5. Leaves acuminate to subacuminate at apex; staminate inflorescence, including peduncle, 8–15 cm long. *S. duckei.*
      5. Leaves obtuse or rounded at apex; staminate inflorescence, including peduncle, abbreviated, 3–6.5 cm long, the inflorescence portion 2.5–5 cm long. 4. *S. spicata.*
   4. Staminate inflorescence pendulous.
      6. Tertiary venation prominently and loosely reticulate on both surfaces; midrib terminating abruptly 6–8 mm below tip of leaf-blade; leaf-blades broadly rounded to truncate at apex. 3. *S. reticulata.*
      6. Tertiary venation not reticulate; midrib terminating at tip of leaf-blade; leaf-blade obtuse to acuminate at apex.
         7. Staminate corolla-lobes acute or subacute; staminate corolla-tube shorter than lobes. 2. *S. acutiloba.*
         7. Staminate corolla-lobes obtuse or rounded at apex; staminate corolla-tube longer than the lobes.
            8. Leaf-blades 2.5–3.8 cm broad; staminate calyx 5 mm broad. *S. reflexa.*
            8. Leaf-blades mostly (3–)4–5 cm broad; staminate calyx 3.5–4 mm broad. 5. *S. penduliflora.*

1. **Stachyarrhena acuminata** Standl. in Field Mus. Nat. Hist., Bot. Ser. **22** : 123. 1940.

Type. Borba, Rio Madeira, Prov. Amazonas, Brazil, 8 Nov 1935, *A. Ducke 35053* (holotype F).

Distribution. Amazonian forest of non-inundated areas in Territorio Amapá and Amazonas, Brazil. In addition to the type specimen, the following collection belongs here: shadow of upland forest, vicinity Camp 12, 1° 11′ N, 52° 8′ W, Rio Araguari, Amapá, 1 Oct 1961, *Pires, Rodrigues & Irvine 51403*.

2. **Stachyarrhena acutiloba** Steyermark, sp. nov.

Arbuscula; foliis petiolatis, petiolis 2–2.7 cm longis glabris; laminis oblanceolatis apice abrupte hebite acuminatis, acumine 10–12 mm longo 4–5.5 mm lato, basi subacuminatis 14.5–16 cm longis 4.5–5.7 cm latis glabris; nervis lateralibus utroque latere 10–11; inflorescentia mascula spicato-paniculata pendula 15 cm longa, 2–2.5 cm longe pedunculata, rhachi glabra; inflorescentiae ramis inferioribus 2–3 mm longis; floribus plerumque pedicellatis, pedicellis 0.5–1 mm longis, vel supremis sessilibus; calyce masculo breviter campanulato 2 mm longo 3 mm lato apice truncato minute 5-repando-denticulato extus glabro verruculoso; corolla mascula breviter hypocrateriformi, tubo lobis breviori 3–3.25 mm longo basi 2 mm lato fauce 3 mm lato extus glabro intus parte basilari 2 mm glabro superne hirsutulo, lobis late ovatis subfalcatis apice subacutis 4.5 mm longis 3 mm latis prominente carinatis extus glabris, intus glabris infra medium medio strigoso-hirsutulo excepto; antheris lineari-oblongis apice acutis 2.8–3 mm longis, filamentis ca. 1 mm longis.

Type. Arbor parva; inflorescentiis pendulis; floribus virescenti-albis; silva non inundabili prope rivulum, Tabatinga, Amazonas, Brazil, 24 Nov 1945, *A. Ducke 1844* (holotype NY).

This species is noteworthy in having the corolla-tube shorter than the lobes, the acute to subacute, carinate corolla-lobes, and acuminate to subacuminate leaf-blades.

3. **Stachyarrhena reticulata** Steyermark, sp. nov. Fig. 33, A–D.

Frutex ad 4-metralis, ramis canis glabris; stipulis suborbiculari-ovatis apice rotundatis 2.5–3 mm longis glabris; foliis oppositis petiolatis, petiolis 6–13 mm longis glabris; laminis obovato-oblongis apice late rotundatis vel truncatis 6–13 cm longis 3–5 cm latis glabris, venulis tertiariis supra conspicue laxe reticulatis, subtus minus conspicue reticulatis, costa media subtus elevata infra apicem laminae 6–8 mm terminanti; inflorescentia mascula spicata pendula vel patenti 6–13 cm longa, 2–5 cm longe pedunculata, rachi glabri ca. 2 mm lata; floribus sessilibus; calyce masculo campanulato 2.5–3.25 mm longo apice 3.5–4.5 mm lato apice truncato vel inaequaliter subundulato utrinque glabro; corolla mascula late campanulata 6.5 mm longa, tubo 3.5 mm longo basi 2.75–3.25 mm lato fauce 4–5 mm lato intus parte basilari 1.25 mm glabra ceterum ad faucem dense hirsuto, lobis late suborbiculari-ovatis vel suborbicularibus apice rotundatis vel late obtusis 3–3.25 mm longis 2.5–3 mm latis, extus glabris verruculoso-papillatis, intus glabris basi ipsa hirsuta excepta; antheris lineari-oblongis 3.7 mm longis 1 mm latis glabris, connectivo in acumen subacutum 0.3–0.4 mm longum producto, basi rotundatis; fructu ovoideo vel globoso 3.5–4.5 cm longo 3–5 cm lato apice basique obtuso vel rotundato glabro.

Type. Shrub to 4 m; flowers white; occasional along drowned river margin between San Fernando de Atabapo and Cacagual, Territorio Federal Amazonas, Venezuela, at alt. 130 m, 18 Nov 1953, *Bassett Maguire, John J. Wurdack & George S. Bunting 36259* (holotype NY, staminate). Paratypes (all pistillate). Amazonas, Venezuela: en terreno arenoso en areas arboreadas, Yavita, en la

margen del riachuela Temi, at alt. 280 m, *Williams 13863;* acuatico, en medio del Río Sanariapo, cerca de su boca, at alt. 120 m, *Williams 16050;* en los claros en la margen del Caño Temi, Yavita, *Williams 14071.*

This species is related to *S. penduliflora* K. Schum., from which it differs in the rounded tips of the leaves, the strongly reticulated leaf-blades, and the characteristic abrupt termination of the midrib before reaching the tip of the blade. The special characters of the leaves of this species enabled the placing of the fruiting collections together with the staminate specimens as representing the same taxon.

The vernacular name of the fruiting specimens is given as ''pendare'' and ''caruto.'' The *Williams* collections, cited below, had all been questionably determined previously by Standley as *Duroia fusifera.*

4. **Stachyarrhena spicata** Hook. f. in Hook. Ic. Pl. *t. 1068.* 1870.

Schradera spicata Spruce ex Hooker f. l. c. as syn.
Schadera spicata var. *multinervis* K. Schum. in Mart. Fl. Bras. **6**(6): 370. 1889, type: ad flumina Casiquiare, Vasiva et Pacimoni, 1853–4, *R. Spruce 3322.*
Stachyarrhena longifolia Hook. f. in Hook. Ic. Pl. *t. 1068.* 1870, type: ad flumina Casiquiiare, Vasiva et Pacimoni, Territorio Federal Amazonas, Venezuela, *R. Spruce 3346.*

Type. Barra, Prov. Rio Negro, Brazil, Dec–Mar 1850–51, *R. Spruce 993* (holotype K, isotype NY).

Stachyarrhena longifolia does not appear sufficiently distinct from *S. spicata* to warrant specific recognition. Although stated in Martius's Flora Brasiliensis (p. 370) as from ''Brasilia septentrionalis,'' the type collection (*Spruce 3346*) originated from Venezuela. I have seen only a photo of the type of *S. longifolia.* The only perceptible differences between it and *S. spicata* are in the length of the inflorescence (3–4.5 cm long in *S. spicata,* 6.5 cm long in *S. longifolia*) and shape and apex of leaf-blades (obovate or oblong-lanceolate in *S. spicata* with broadly rounded or obtuse apex, narrowly oblong in *S. longifolia* with obtuse apex), which differences do not stand out sufficiently distinct.

5. **Stachyarrhena penduliflora** K. Schum. in Mart. Fl. Bras. **6**(6): 370. 1889.

Type. In humidis prope Santarem, Pará, Brazil, *Riedel 1574.*

Distribution. Orinoco River, Amazonas, Venezuela, and Amazonas, Brazil, generally in riverine forest at alt. 90–200 m. VENEZUELA. Amazonas: forest near Culebra, Río Cunucunuma, *Maguire, Cowan & Wurdack 29757* (staminate); Río Pargueni, Middle Orinoco River, 3 km above mouth, *Wurdack & Monachino 39756* (staminate); drowned margins of Río Horeda 1–4 km above mouth, Middle Orinoco River, *Wurdack & Monachino 39895* (staminate); en las costas bajas, arboreadas y periodicamente anegadas en un caño que corre al Orinoco arriba de Esmeralda, *Williams 15498* (fruit); en la selva alta tupida de tierra, firma, isla de Trapichote, Delta del Ventuari, *Williams 14988* (fruiting); en la margen anegada y arboreada del Caño Macasi, Capihuari, Alto Casiquiare, *Williams 15795.* BRAZIL. Pará: Belterra, beira do Rio Tapajos, igapó, *Black 47–1739;* Amazonas: Maués, praia alagavel do Rio, *Pires 88.*

The fruiting specimens collected by Williams were originally identified as *Alibertia obidensis* Huber by Standley. They are definitely not to be identified with that genus. They are placed in the present treatment with *Stachyarrhena,* and appear to have the same type of leaf shape and suborbicular stipule truncate at the apex which are present in the staminate material of *S. penduliflora*, with which species they are provisionally identified.

Alibertia A. Rich. Mem. Soc. Hist. Nat. Paris **5**: 234. *pl. 21, fig. 1.* 1830.

Type species. *Alibertia edulis* (L. Rich.) A. Rich.

The present account is an attempt to account for the species of Venezuela and adjacent Guayana. The genus is in great need of revision and must await further more detailed study.

Key to the Species of *Alibertia* in Venezuela and Adjacent Guayana

1. Staminate calyx-teeth ciliolate, prominent, 1–1.5 mm long; younger stems and those of the present year's growth moderately hirtellous. 2. *A. bertierifolia.*

1. Staminate calyx-lobes glabrous, inconspicuous or if developed, less than 1 mm long; younger stems and those of the present year's growth glabrous.
  2. Staminate corolla-lobes 3; anthers 3; staminate inflorescence short-pedunculate with secondary branched axes. 6. *A. triloba.*
  2. Staminate corolla lobes 4–5; anthers 4–5; inflorescence sessile, without secondary branched axes.
    3. Stipules truncate or rounded at summit, 1.5–3 mm high; corolla-tube completely glabrous within. 4. *A. myrciifolia.*
    3. Stipules acute, acuminate, or setaceous, 4–11 mm high; corolla-tube pubescent within in some portion of upper half.
      4. Stipules narrowly triangular-setaceous; staminate corolla-lobes narrowly lanceolate; exterior of corolla-tube of staminate corolla finely cinereous-pulverulent. 5. *A. triflora.*
      4. Stipules broadly ovate to ovate-oblong, acute or subacute; staminate corolla-lobes ovate; exterior of corolla-tube of staminate corolla densely sericeous-strigose.
        5. Upper surface of leaf-blades drying dark, often lustrous, the teriary venation conspicuous; lower surface of leaf-blades with inconspicuous or poorly developed lateral nerves; calyx-tube of staminate flowers 2.5–3 mm long; stipules 4–5 mm long; petiole 2–5 mm long; leaf-blades gradually narrowly acute to acuminate at both ends, 1.5–4 cm broad, 3–4-1/2 times as long as broad; pubescence of outer surface of corolla-tube cinereous-pulverulent. 1. *A. acuminata.*
        5. Upper surface of leaf-blades drying dull brown, bronze, or even greenish, opaque, not lustrous, the tertiary venation not showing or inconspicuous; lower surface of leaf-blades with prominent or well-developed lateral nerves; calyx-tube of staminate flowers 3–5 mm long; stipules 5–13 mm long; petiole 5–12 mm long; leaf-blades abruptly narrowed at apex, subacute, rounded, or subobtuse at base, 3–7.5 cm broad, 1-3/4–3 times as long as broad; pubescence of outer surface of corolla-tube densely buff sericeous-strigillose. 3. *A. latifolia.*

1. **Alibertia acuminata** (Benth.) Sandwith, Kew Bull. **1931**: 470. 1931.

Key to the Varieties of *Alibertia acuminata*

1. Leaf-blades acuminate or subacuminate at apex, the tertiary venation on upper surface not conspicuously showing as a pale network against a dark background. var. *acuminata.*

1. Leaf-blades obtuse or rounded at apex, the tertiary venation on upper surface showing conspicuously as a gray or white network against a dark background. var. *obtusiuscula.*

1a. **Alibertia acuminata** var. **acuminata.**

Cordiera ? acuminata Benth. in Hook. Jour. Bot. **3**: 221. 1841.
Alibertia trinitatis Sprague & Williams in Fl. Trin. & Tob. **2**(1): 19. 1928.

Type. British Guiana, *Robert Schomburgk 112.S* (K).

Distribution. Trinidad, British Guiana, and southeastern Venezuela, at altitudes generally below 500 m. TRINIDAD. Piarco Savannah, *Sandwith 1946;* south of Dabadie, near Caroni river, *Britton & Hazen 731.* BRITISH GUIANA. *Schomburgk 112.S* (photo of type at K); Essequibo River, *Sandwith 217, 218;* Camaria Falls, Cuyuni River, *Forest Dept. 6953.* VENEZUELA. Rebalsas del Caroni, estado Bolívar, *Cardona 2563;* cerca de la boca del Ikabaru en el río Caroní, *Cardona 1722.*

In the Venezuelan specimens cited, a maximum width of 4 cm is attained by the leaf-blades. This variety approaches typical *A. edulis* in leaf size, shape, and acuminate apex, but differs in the shorter calyx-tube without teeth or very reduced teeth, shorter and more globose fruit, and shorter stipules. In this variation the leaf-blades are prominently narrowed at both ends and are 3–4 1/2 times as long as broad.

1b. Alibertia acuminata var. **obtusiuscula** Steyermark, var. nov.

A var. *acuminata* differt laminis foliorum apice plerumque obtusis vel paullo rotundatis interdum acutis supra venulis tertiariis prominente reticulatis pallidis.

Type. Arbusto de 2–3 m; frutos redondos de color verde-oscuro al madurarse; en los alrededores de Ciudad Bolívar, estado Bolívar, Venezuela, 30 Jan 1950, *Leandro Aristeguieta 5264* (holotype VEN). Paratypes. VENEZUELA. Estado Monagas: forested slopes above Río Amana, at La Traviesa Mene Grande Oil Company Camp, 7 km west of Santa Barbara, at alt. 244 m, *Steyermark 61760;* Terr. Amazonas: Isla Carestia, at Saltos Carestia y Gallo, 5 km below Sanariapo, at alt. 100–200 m, *Maguire, Wurdack & Bunting 36160.*

2. Alibertia bertierifolia Schum. in Mart. Fl. Bras. **6**(6): 384. 1889.

Type. Río Negro, Brazil, Oct 1861, *Richard Spruce 3293.*

Distribution. Río Negro, Brazil, and Territorio Amazonas, southwestern Venezuela. BRAZIL. *Riedel 1453;* river banks and flood sands, Muyrapenima, Rio Negro, *Tate 67.* VENEZUELA. Sabanetas cerca de la margen de los caños al frente de la isla de Callare, raudal de Trapichote, Delta del Ventuari, Amazonas, at alt. 125 m, *Williams 14998;* Amazonas, *Williams 16006.*

The five prominent, setaceous calyx-lobes and long setaceous, persistent stipules present in this species are characters mostly at variance with other members of the genus *Alibertia.* The species appears to be most closely related to *A. triflora* (A. Rich.) K. Schum., in which the calyx teeth are somewhat conspicuous and the stipules are elongated-triangular.

Alibertia edulis (L. Rich.) A. Rich. ex DC. Prodr. **4**: 443. 1830.

Genipa edulis L. Rich. Act. Soc. Hist. Nat. Paris **1**: 107. 1792.

The series involving *Alibertia edulis, A. acuminata,* and *A. latifolia* is a complex one, and *A. edulis* has been variously interpreted to the extent that material so identified in herbaria includes a wide variation and assortment of specimens. So far as my present interpretation of *A. edulis* goes, material previously identified from Venezuela as that species must be placed with *A. latifolia* and *A. acuminata.* Venezuelan material now placed in *A. acuminata* is mainly in the fruiting stage and will have to be recollected in the flowering stage with both sexes represented in order that the problem be clarified.

The main differences between *A. acuminata* and *A. latifolia* were presented in the key at the beginning of the treatment of this genus. The following paragraphs are presented to elaborate further various differences between the related taxa in the *A. edulis* complex.

Both *A. edulis* and *A. acuminata* have the leaf-blades oblong-lanceolate, narrowed at both ends, turning dark on drying with a tendency for the tertiary venation to be prominent on the upper side, but with the lateral nerves and venation inconspicuous on the lower side. A sublustrous to lustrous effect is usually evident in *A. acuminata*. As contrasted with the previous presentation, *A. latifolia* has leaves proportionally fewer times longer than broad with a shorter, more abrupt apex and more obtuse to rounded base of the leaf-blade, of a more ovate-oblong shape, and the leaves upon drying are greener and less dark, the tertiary venation not apparent above, but the lateral nerves are prominent below, and there is usually a greater development of pubescence on the lower side along the midrib and in the axils of the midrib and lateral nerves.

In the historical type of *A. edulis* from British Guiana, along with other South American material, the stipule is only acute to short-acuminate and varies from usually 5–8 mm long, and is glabrous to glabrate without. In specimens from Central America, Mexico, and the West Indies identified as *A. edulis,* the stipule is more setaceous and elongated, prolonged to 7–18 mm long. This is especially evident in the Panamanian *A. longistipulata* Riley and *A. panamensis* Riley, in which the stipules are caudate to setaceous. The West Indian material, mainly Cuban, has mainly conspicuous stipules up to 15 mm long and long-caudate or setaceous. If the stipule character is of sufficient importance, then most of the material identified as *A. edulis* from Central America, Mexico, and the West Indies will have to be placed into the *A. longistipulata-A. panamensis* alliance. Most of the South American material (including specimens cited by Cuatrecasas as typical *A. edulis*) of typical *A. edulis* with the shorter acute-tipped stipules agrees with Richard's description of *A. edulis*. The acute character of the stipule is also shown in Richard's plate illustrating *A. edulis*.

In *A. latifolia* and *A. acuminata* the stipule, as in typical *A. edulis* from South America, is, likewise, short, acute to subacuminate, broadly ovate to deltoid, and 2–13 mm long, becoming larger in *A. latifolia* than in *A. acuminata*.

The fruit is apparently more depressed in typical *A. edulis* from South America than in either *A. acuminata* or *A. latifolia,* in which the fruit is globose. It appears to be larger in typical *A. edulis* than in *A. acuminata* or *A. latifolia*.

The corolla of the staminate flowers in *A. edulis* is longer and broader than that of either *A. acuminata* or *A. latifolia*. The pubescence on the outer surface of the staminate corolla in *A. latifolia* is more densely sericeous or buff-strigose than in *A. edulis* or *A. acuminata*. In the two latter species the hairs are shorter and gray, presenting a cinereous-pulverulent surface.

The calyx of the staminate flowers presents differences also. In typical *A. edulis* of South America, as well as in material from Central America, Mexico, and the West Indies, the calyx is provided with teeth up to 1–2 mm. In *A. latifolia* the calyx of the staminate flowers is usually truncate with little or no development of any teeth, and the same is true in the staminate calyx of *A. acuminata*. In the pistillate calyx of typical *A. edulis* from South America the teeth are less than 1 mm, being less conspicuous than in the calyx of the staminate flowers. In the pistillate calyx of *A. latifolia* the calyx, as in the staminate flowers, is also truncate and either without teeth or only faintly lobate. The size of the calyx is similar in both *A. edulis* and *A. latifolia,* but in *A. acuminata* is much shorter.

The isotype of *Alibertia edulis* which I have examined at NY is a pistillate specimen with the pistillate flower solitary. The hypanthium in this specimen is sparsely appressed-pubescent near the base, 6 mm long and 4.5 mm broad; the calyx-tube is 5 mm long and 6.5 mm broad with 6 triangular subulate teeth arising from the truncate apex of the hypanthium, and these teeth are about 0.5 mm long and moderately short appressed-puberulent without. The broadly ovate stipules are acute, glabrous, and 5–7 mm long.

3. **Alibertia latifolia** (Benth.) Schum. in Mart. Fl. Bras. **6**(6): 386. 1889.

Cordiera (?) *latifolia* Benth. Jour. Bot. 3: 221. 1841.

Type. British Guiana, *Schomburgk 91.S* (fragment of type F).

Key to the Varieties of *Alibertia latifolia*

1. Calyx-tube of staminate flowers 4–6 mm long; corolla-lobes of staminate corolla 7–10 mm long. var. *latifolia.*
1. Calyx-tube of staminate flowers 3 mm long; corolla-lobes of staminate corolla 6–7 mm long. var. *pargueniana.*

3a. **Alibertia latifolia** Benth. var. **latifolia.**

Cordiera (?) *latifolia* Benth. Jour. Bot. 3: 221. 1841.

Alibertia latifolia var. *parvifolia* Schum. in Mart. Fl. Bras. 6(6): 386. 1889 (excluding *Cordiera* (?) *acuminata* Benth.), type: Roraima (Venezuela), *Schomburgk 735* (K).

Alibertia granulosa Rusby, Descr. New Sp. S. Am. Pl. 133. 1920, type: Santa Catalina, lower Orinoco, Venezuela, *Rusby & Squires 174* (NY).

Distribution. British Guiana, Venezuela, and northern Brazil, mostly along streams between 100–500 m alt., occasionally found at higher altitudes. BRITISH GUIANA. banks of Essequibo, 1 mile below Urisaru Falls, *Forest Dept. Record No. 6148; Schomburgk 91.S.* VENEZUELA. Arabupu, Mt. Roraima district, *Pinkus 96;* Raudal de Guaiquinima en la base del Cerro Guaiquinima, *Steyermark 90800;* Boca Carapo, Río Paragua, *Cardona 921;* Puerto Paez, estado Apure, *Velez 2215;* Sacupana, Delta Amacuro, *Aristeguieta 4035;* Catalina, *Rusby & Squires 174;* Caño del Corisal-Corisal, Orinoco Delta, *Bond, Gillin & Brown 206;* Río Ventuari below the mouth of Río Paru, Amazonas, *Maguire, Cowan & Wurdack 30829.* BRAZIL. Alto Amazonas secus fluvium Rio Negro inter Barcellos et S. Isabel, *Spruce 1972* (photo at NY of Munich specimen).

3b. **Alibertia latifolia** var. **pargueniana** Steyermark, var. nov.

A var. *latifolia* differt tubo calycis florium masculinorum 3 mm longo; lobis corollae masculinae 6–7 mm longis; stipulis ovatis subacutis 4–4.5 mm longis extus glabris vel glabratis ad subhirtellis; laminis foliorum oblongo-ellipticis vel oblongis apice late obtusis vel rotundatis basi obtusis vel late rotundatis, 7–10 cm longis 3–6 cm latis, subtus costa media nervis lateralibusque dense puberulo-hirtellis atque in axillis barbatis, nervis lateralibus utroque latere 7–10.

Type. Small tree; flowers white; occasional at river edges 1–10 km above mouth, Río Pargueni, estado Bolívar, Venezuela, at alt. 90 m, 10 Dec 1955, *Wurdack & Monachino 39784* (holotype NY).

4. **Alibertia myrciifolia** (Spruce ex K. Schum.) K. Schum. in Mart. Fl. Bras. **6**(6): 393. 1889.

Cordiera myrciifolia Spruce ex K. Schum., l. c. nomen invalidum in synonymis.

Type. Brazil, in vicinibus Santarem, Prov. Pará, Sep 1850, *Spruce 978* (NY).

Key to the Varieties of *Alibertia myrciifolia*

1. Lateral nerves of the leaf-blades 5–8 on each side of the midrib; leaf-blades mainly 3–6(–11) cm long by 1.5–3(–5) cm wide, the shortly prolonged acumen mainly 2–3(–11) mm long. var. *myrciifolia.*
1. Lateral nerves of the leaf-blades 10–12 on each side of the midrib; leaf-blades 7.5–15 cm long by 4.5–8.5 cm wide, the acumen prolonged 12–15 mm. var. *tepuiensis.*

4a. **Alibertia myrciifolia** var. **myrciifolia.**

Distribution. Suriname, Venezuela, and Brazil. SURINAME. Brownsberg, *Herb. No. 6563.* VENEZUELA. Vicinity of Arabupu, Mount Roraima district, *Pinkus 96;* between Los Castillos de Guayana and Piacoa, *Steyermark 86269;* Chimantá Massif, *Steyermark 74676.* BRAZIL. In vicinibus Santarem, Pará, *Spruce 978;* Santarem, campos, *Spruce 1092;* Ceará, *Gardner 1688;* Mattogrosso, *Otto Kuntze s.n., Spencer Moore 53, 158;* frontier between Territorio do Rio Branco, Brazil, and Estado Bolívar, Venezuela, between Vista Geral and Serra Sabang, *Maguire & Maguire 40285.*

4b. **Alibertia myrciifolia** var. **tepuiensis** Steyermark, var. nov.

A var. *myrciifolia* differt foliis majoribus, laminis late ovatis 7.5–15 cm longis 4.5–8.5 cm latis, acumine elongato 12–15 mm longo, nervis lateralibus utroque latere 10–12.

Type. Shrub 2–3 m high; flowers white; occasional in woodland, northeast slopes, Serra Tepequem, Territorio do Rio Branco, Brazil, at alt. 800 m, 22 Nov 1954, *Bassett Maguire & Celia K. Maguire 40009* (holotype NY).

Alibertia myrciifolia possesses smaller fruits than in the other species treated in this paper. The fruits are globose, 10–11 mm high and 10–11 mm broad. The tips of the shoots around the inflorescence and in the vicinity of the leaf-nodes are usually glossy with a lacquered resinous exudate. In var *myrciifolia* the leaves are often reduced to only 3–5 cm long and 1.5–3 cm broad with shortly prolonged obtuse acumen of usually 2–3 mm in length, but in some collections (*Steyermark 74676*) attaining 10 mm with leaf-blades up to 11 cm long and 5 cm wide. The latter collection approaches the var. *tepuiensis.*

5. **Alibertia triflora** (A. Rich.) K. Schum. in Mart. Fl. Bras. **6**(6): 392. 1889.

Cordiera triflora A. Rich. Mem. Soc. Hist. Nat. Paris **5**: 222. *pl. 20, fig. 2.* 1830; A. DC. Prodr. **4**: 445. 1830.

Type. In ripis fluvii Kourou. British Guiana, Poiteau, *Richard 365* (B, photo NY).

Distribution. British Guiana and Suriname. SURINAME. Gonini river, *Versteeg 87;* Jacob kondre, Saramacca river, *Maguire 23858.*

According to Bremekamp, this species is often confused with true *A. edulis.* He stated that the details of the ovary, as depicted in the plate of Richard, are incorrect. However, the references cited both by Bremekamp and by Schumann in their respective treatments of the species refer to page 142, plate 10, figure 2, whereas the proper citation should be volume 5, page 222, plate 20, figure 2, 1830.

6. **Alibertia triloba** Steyermark, sp. nov.

Arbor 3-metralis; stipulis persistentibus ovato-oblongis obtusis 1.5–4 mm longis, substrigosis vel glabris; foliis petiolatis, petiolis 6–8 mm longis; laminis coriaceis ellipticis apice abrupte obtuseque caudatis, acumine 10–13 mm longo spatulato-rotundato, basi manifeste angustatis, 9–10.5 cm longis 4.5–5 cm latis, utrinque glabris, nervis lateralibus utroque latere 7–8; inflorescentia masculina breviter pedunculata, pedunculo 1–1.5 mm longo, 3–9-flora, ramis secundariis ad 2.5 mm longis; florium masculinorum flori centrali sessili, ceteris pedicellatis, pedicellis glabratis 1–1.5 mm longis; calyce masculino 2 mm alto 2 mm lato apice truncato vel minute repando, extus intusque minute puberulenti, margine ciliolato; corollae tubo 9–11 mm longo 1.5 mm lato anguste cylindrico, extus dense cano-pulverulenti intus glabro subpapillato, lobis 3, interdum 4, ovato-lanceolatis acuminatis 7.5 mm longis 2.5 mm latis extus puberulentibus intus glabratis; antheris tribus 5 mm longis supra basin corollae 1.5 mm insertis.

Type. Tree to 3 m; leaves thin, coriaceous, slightly brittle, dark green above, lighter beneath; calyx and corolla-tube green; corolla-lobes white, 3, slightly fragrant; frequent in mixed evergreen forest between first and second cliffs, along northeast side, Mount Ayanganna, Upper Mazaruni River basin, British Guiana, at alt. 900–1100 m, 7 Aug 1960, *S. S. Tillett, C. L. Tillett & R. Boyan 45180* (holotype NY).

This species is unusual in having a 3-lobed (rarely 4-lobed) corolla of the staminate flower. From *A. myrciifolia* it differs further in the denser buff tomentum on the outer surface of the corolla-tube, shortly pedunculate staminate inflorescence with secondary branched axes, and pedicels up to 2.5 mm long.

Tribe Retiniphylleae

Retiniphyllum Humb. & Bonpl. Pl. Aequin. **1**: 86. *t. 25*. 1808.

Ammianthus Spruce ex Benth. & Hook. f. Gen. Pl. 2: 98. 1873.
Commianthus Benth. in Hook. Jour. Bot. 3: 223. 1846.

Type species. *R. secundiflorum* Humb. & Bonpl.

Retiniphyllum is a genus of shrubs or small trees confined to the northern part of South America, where it is distributed in the Guianas, Brazil, southern Venezuela, and Amazonian eastern Colombia and Peru.

In most of the species a resinous exudate covers the young shoots and portions of the inflorescence.

Key to the Species of *Retiniphyllum*

1. Flowers or fruits subcapitate or fasciculate at the tips of the branches.
    2. Calyx-tube glabrous; interior of corolla-tube without a densely bearded annulus; corolla-lobes nearly equaling the corolla-tube in length, the corolla-tube 14.5–15 mm long. 8. *R. pauciflorum.*
    2. Calyx-tube more or less pubescent, sometimes merely puberulent in upper half; interior of corolla-tube with a densely bearded annulus; corolla-lobes much shorter than the corolla-tube in length, the corolla-tube 22–29 mm long.

3. Involucel subentire; pedicels none, the flowers sessile; petiole 2–3 mm long; species of Ceará, Brazil. 10. *R. cearense.*
3. Involucel prominently denticulate-margined; pedicels 1–7 mm long; petiole 3–9 mm long; species of Venezuela and British Guiana.
    4. Pedicels slender, 0.75–1 mm in diam, glabrate; summit of calyx subtruncate, repand-denticulate; lower surface of leaves glabrous or nearly so, the pubescence short, appressed, confined to midrib and nerves; upper half of calyx puberulent; leaves with tertiary venation prominently reticulate on both surfaces. 7. *R. laxiflorum* × *R. scabrum.*
    4. Pedicels stouter, more or less pubescent; summit of calyx chiefly ovate- to triangular-toothed, rarely repand-denticulate in one variation; lower surface of leaves sparsely to densely pubescent, the hairs of the midrib and lateral nerves beneath densely scabrous-strigose or hirtellous; calyx densely hirtellous; tertiary venation of leaves frequently not prominent, especially that of upper surface. 9. *R. scabrum.*

1. Flowers or fruits spicate or short- to long-racemose on a short to generally elongated rachis.
    5. Flowers or fruits pedicellate.
        6. Pedicels subtended by conspicuous elongated bracts.
            7. Leaf-blades broadly rounded or subtruncate and retuse or emarginate at apex, densely finely white tomentellose on lower surface; corolla lobes 7–8 mm long; corolla-tube 13–14 mm long; calyx-tube strigose-sericeous within; pedicels 1–3 mm long; Venezuela and Brazil. 5. *R. secundiflorum.*
            7. Leaf-blades abruptly acuminate at apex, densely pilose on lower surface; corolla-lobes 10–14 mm long; corolla-tube 18–22 mm long; calyx-tube glabrous within; pedicels 5–12 mm long; Peru. 6. *R. fuchsioides.*
        6. Pedicels lacking conspicuous elongated bracts, the bracts obsolete or poorly developed.
            8. Calyx tubular, longer than broad, 5–9 mm long.
                9. Pedicels 9–23 mm long; flowers and pedicels few, mainly 3–7(rarely 9). 7. *R. laxiflorum.*
                9. Pedicels 1–7 mm long; flowers and pedicels more numerous, 8–17.
                    10. Leaf-blades linear to narrowly ligulate or linear-oblong, the lower surface densely strigose, obscuring the tertiary venation; inflorescence 2.5–3 cm long, the flowers 8–10, closely crowded on the rachis; corolla-tube 4–6 mm long; filaments 3.5 mm long. 11. *R. cataractae.*
                    10. Leaf-blades oblong, elliptic-oblong, oblong-elliptic, oblanceolate, or oblong-oblanceolate, the lower surface glabrous except for midrib and lateral nerves, the tertiary venation reticulate and conspicuous; inflorescence 4.8–11.5 cm long, the flowers 10–17, loosely scattered on the rachis; corolla-tube 7.5–14 mm long; filaments 5.5–11 mm long.
                        11. Corolla greenish-white or cream tinted pink; bearded annulus located 3/4–7/8 distance up corolla-tube; corolla-tube 7.5 mm long, shorter than corolla-lobes. 12. *R. tepuiense.*
                        11. Corolla coral red, red, or pink; bearded annulus located 1/3–3/8 distance up corolla-tube; corolla-tube 12–14 mm long, often equaling corolla-lobes. 13. *R. maguirei.*
            8. Calyx shallowly cup-shaped or campanulate, broader than long or as broad as long, 1–3 mm long.
                12. Involucel entire-margined or somewhat undulate; corolla-tube 18–20 mm long; fruit 5-angled. 3. *R. martianum.*
                12. Involucel 5–6-lobed; corolla-tube 10–15 mm long; fruit 10-angled or costate.
                    13. Corolla green, the tube 15 mm long, lobes 10 mm long; bearded annulus located slightly below middle of corolla-tube; leaf-blades minutely scabridulous beneath. 2. *R. chloranthum.*
                    13. Corolla-lobes green with maroon at base, the tube coral-red becoming buff above, tube 10–13.5 mm long, lobes 6.5–8 mm long; bearded annulus located 1/4–1/3 distance up corolla-tube; leaf-blades glabrous beneath. 1. *R. concolor.*

5. Flowers or fruits sessile.
  14. Involucel conspicuously 6–9-lobed; rachis of inflorescence densely pilose or hirsutulous with spreading hairs; upper surface of leaf-blades scabrid-hirsutulous, lower surface hirsutulous, the hairs on lower midrib and lateral nerves 1–2 mm long. 4. *R. pilosum.*
  14. Involucel truncate and entire or repand-denticulate or undulate, not prominently lobed; rachis of inflorescence glabrous or granular-pulverulent to shortly puberulous; upper surface of leaf-blades glabrous or nearly so, lower surface glabrous or granular-pulverulent to densely hirtellous, but the hairs 0.5 mm or less long.
    15. Rachis of inflorescence densely short-puberulous; midrib of lower leaf surface densely hirtellous, the lateral nerves and tertiary veins on lower surface strigose to hirtellous; interior of corolla-tube without a bearded annulus. 14. *R. schomburgkii.*
    15. Rachis of inflorescence glabrous or granular-pulverulent; lower leaf surface glabrous or granular-roughened or minutely scabridulous; interior of corolla-tube with a well-developed bearded annulus.
      16. Calyx and hypanthium 2.5–4 mm long.
        17. Corolla-lobes shorter than corolla-tube; bearded annulus about 1/3 distance up corolla-tube; lower leaf surface granular-roughened; apex of leaf-blades abruptly caudate, the acumen 5–14 mm long and 1–3 mm wide. 3. *R. martianum.*
        17. Corolla-lobes longer than corolla-tube; bearded annulus about 5/8 distance up corolla-tube; lower leaf surface glabrous; apex of leaf-blades rounded or obtuse to acute or subacuminate. 15. *R. truncatum.*
      16. Calyx and hypanthium 4.5–10 mm long.
        18. Calyx and hypanthium 4.5–5.5 mm long.
          19. Lateral leaf nerves 9–11 on each side; inflorescence 5–7 cm long; corolla-lobes equaling or longer than the corolla-tube. 20. *R. pallidum.*
          19. Lateral leaf nerves 15 on each side; inflorescence 12 cm long; corolla-lobes shorter than the tube. 16. *R. kuhlmannii.*
        18. Calyx and hypanthium 6.5–10 mm long.
          20. Corolla greenish-white; corolla-lobes equaling length of corolla-tube; calyx nearly entire at subtruncate summit, merely inconspicuously repand. 17. *R. guianense.*
          20. Corolla red; corolla-lobes shorter than corolla-tube; calyx 5-toothed, the teeth subulate to narrowly triangular.
            21. Calyx minutely granular-verruculose without, ribbed from the summit downward; lateral leaf nerves 18–20 pairs; inflorescence 10–17.5 cm long; leaf-blades with conspicuous tertiary venation; rachis of inflorescence granular-pulverulent. 18. *R. speciosum.*
            21. Calyx glabrous, not ribbed; lateral leaf nerves 10–13 pairs; inflorescence 6–10.5 cm long; leaf-blades without conspicuous tertiary venation; rachis of inflorescence glabrous.
              22. Leaf-blades concolored, elliptic-lanceolate or narrowly elliptic, 1.7–2.3 cm broad; corolla-tube 20 mm long; corolla-lobes 16–17 mm long; calyx teeth 1.25–1.5 mm long, triangular-subulate. 19. *R. glabrum.*
              22. Leaf-blades discolored, glaucous-white beneath, ovate-elliptic or oval, 3.5–5 cm broad; corolla-tube 15–17 mm long; corolla-lobes 13 mm long; calyx teeth 0.5 mm long, setaceous-subulate. 21. *R. discolor.*

1. **Retiniphyllum concolor** (Spruce ex Benth.) M. Arg. in Mart. Fl. Bras. **6**(5): 8. 1881. Fig. 34, A, A′.

Commianthus concolor Spruce ex Benth. in Hook. Kew Jour. **5**: 235. 1853.

Type. Borders of an elevated sandy campo, Uanauaca, Brazil, *R. Spruce 2028* (holotype K, photo of type from K at NY, photo of isotype from M at NY).

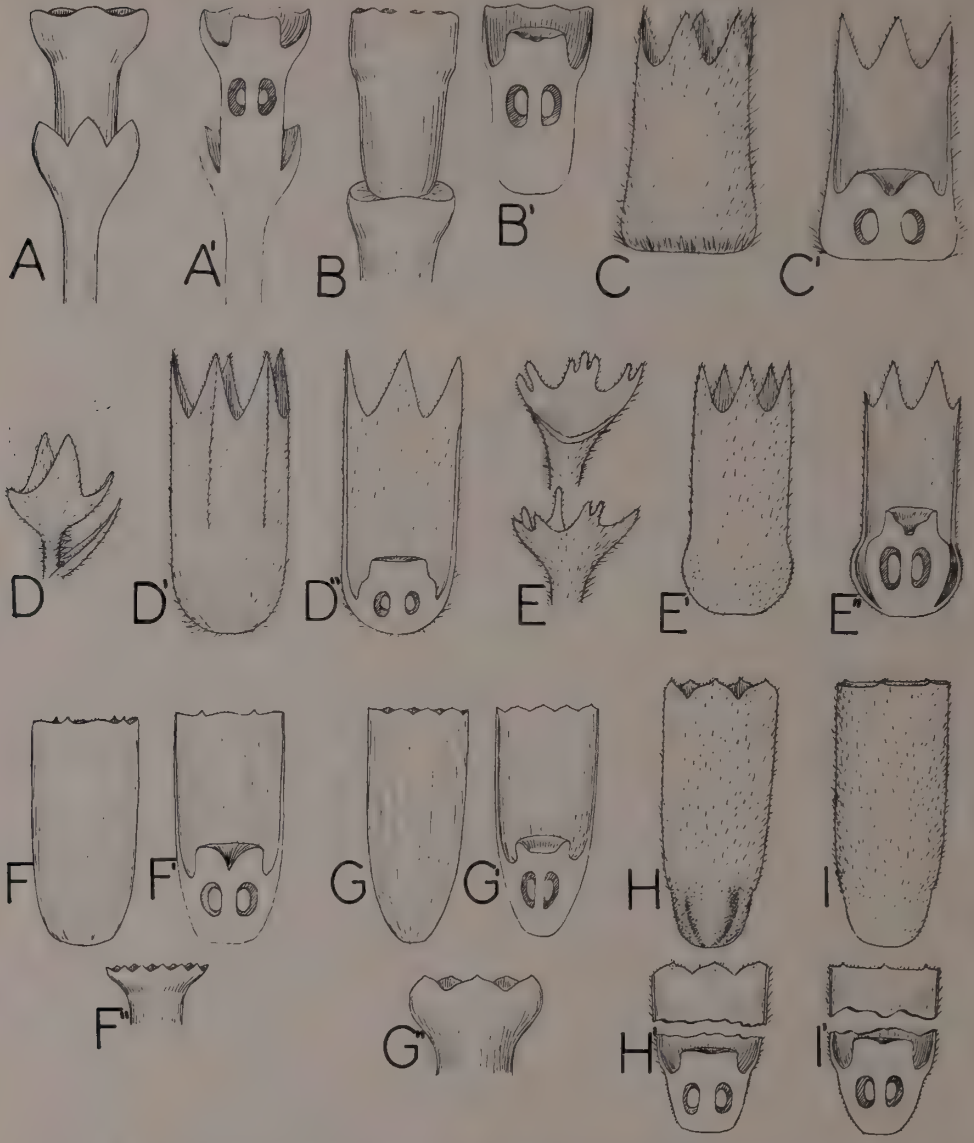

FIG. 34. A–A′, *Retiniphyllum concolor.* A, calyx, hypanthium involucel and pedicel, × 7. A′, vertical section of A, × 7. B–B′, *R. martianum.* B, calyx, hypanthium, involucel, and portion of pedicel, × 7. B′, vertical section of B, × 7. C–C′, *R. pilosum.* C, calyx and hypanthium, exterior view, × 4. C′, vertical section of C, × 4. D–D″, *R. secundiflorum.* D, bract, pedicel, and involucel, subtending base of calyx-tube, × 5. D′, calyx and hypanthium, exterior view, × 5. D″, vertical section of D′, × 5. E–E″, *R. fuchsioides.* E, involucel, above, internal view; below, exterior view, × 7. E′, calyx and hypanthium, × 3. E″, vertical section of E′, × 3. F–F″, *R. laxiflorum* var. *laxiflorum.* F, calyx and hypanthium, × 4. F′, vertical section of F, × 4. F″, involucel, × 4. G–G″, *R. pauciflorum.* G, calyx and hypanthium, × 3. G′, vertical section of G, × 3. G″, involucel, × 15. H–H′, *R. scabrum* var. *erythranthum.* H, calyx and hypanthium, exterior view, × 4. H′, vertical section of H, showing hypanthium and upper portion of calyx-tube and lobes, × 4. I–I′, *R. scabrum* var. *ayangannense.* I, calyx and hypanthium, × 4. I′, vertical section of I, showing hypanthium and upper portion of calyx-tube and lobes, × 4.

Distribution. British Guiana, southern Venezuela, and Amazonian Brazil and Colombia. BRITISH GUIANA. Pakaraima Mountains, Kamarang River-Wenamu trail, Paruima Falls to Paruima Mission, *Maguire & Fanshawe 32464;* low bog-forest bordering Mokay-dai Savannah near mouth of Mokay River, Upper Mazaruni River basin, at alt. ca. 490 m, *S. S. & C. L. Tillett 45349.* VENEZUELA. Estado Bolívar: Sierra Ichún, at alt. 625–725 m, *Steyermark 90254;* cumbre del Cerro Apacará, asociado con *Bonnetia* en bosques pluviales altos, *Cardona 1602;* forested slopes, Abacapá-tepuí, Chimantá Massif, at alt. 750–1100 m, *Steyermark 74845;* just above Techiné-merú along Río Tirica, at alt. 470 m, *Steyermark & Wurdack 128.* Territorio Federal Amazonas: riverine forest just south of Maroa, Río Guiania, at alt. 120–140 m, *Maguire, Wurdack & Bunting 36454; Clusia* "moss-forest" just south of Camp 3, Cerro de la Neblina, Río Yatua, at alt. 650–700 m, *Maguire, Wurdack & Bunting 36824;* along Caño San Miguel just above Limoncito (15 km from Río Guiania, at alt. 100–140 m, *Wurdack & Adderley 43234;* southeastern-facing slopes along Caño Negro, Cerro Duida, at alt. 305 m, *Steyermark 57947;* selva de tierra firma, Capihuara, Casiquiare, *Williams 15556;* selvas de Maroa, at alt. 127 m, *Williams 14192, 14228.* BRAZIL. Uanauaca, *Spruce 2028* (holotype). COLOMBIA. Amazonas: headwaters of Quebrada Guacayá, Río Miritiparaná, Cerro de la Gente Chiquita, *Schultes & Cabrera 16494.* Vaupés: San Felipe and vicinity, Río Negro below confluence of Río Guainia and Río Casiquiare, *Schultes, Baker & Cabrera 18244;* Caño del Caribe between Isla del Venado and San José, Río Guainia, *Schultes, Baker & Cabrera 18255.*

2. **Retiniphyllum chloranthum** Ducke, Trop. Woods **76**: 31. 1943.

Type. Silva humiliore circa campinam arenosam prope flumen Tarumá-miry urbi Manáos vicinum, Amazonas, Brazil, 4 Jul 1941, *A. Ducke 1143.*

Distribution. Known only from the type locality.

3. **Retiniphyllum martianum** M. Arg. in Mart. Fl. Bras. **6**(5): 9. 1881. Fig. 34, B, B′.

R. angustiflorum Krause, in Engl. Jahrb. **40**: 326. 1908, type near Rioja, Dept. Loreto, at alt. 800–900 m, *Weberbauer 4695* (photo and fragment of type from B).

Type. Sylvis ad cataractas Cupatenses prope flumen Japurá, Alto Amazonas, Rio Negro, Brazil, *Martius* (photo of holotype from M at NY).

Distribution. Amazonian Basin, drainage of Rio Negro, Río Vaupés, Rio Caquetá, of Amazonas, Brazil, Venezuela, and Colombia, south to Departamento Loreto, Peru. VENEZUELA. En la selva, Maroa, Alto Rio Negro, Guainia, *Williams 14228* (as to sterile leafy branch), *14192* (as to VEN sheet no. 15965, not sheet no. 15963). COLOMBIA. Amazonas: La Pedrera and vicinity, Cerro de La Pedrera, Rio Caquetá, *Schultes & Cabrera 16295.* Amazonas-Vaupés: Raudal de Jirijirimo, below mouth of Río Kananari, Río Apaporis, *Schultes & Cabrera 15930;* Raudal Yayacopi (La Playa), Río Apaporis, *Schultes & Cabrera 16923;* Cachivera de Jirijirimo, Río Apaporis, *Schultes & Cabrera 12501, 13519, 14059.* Vaupés: Puerto Colombia, Río Guainia, *Schultes, Baker & Cabrera 18156;* Río Paca (tributary of Río Papuri), Wacaricuara and vicinity, *Schultes & Cabrera 19558;* Río Piraparaná (tributary of Río Apaporis), Caño Teemeeña, *Schultes & Cabrera 17220;* Javareté, caatinga forest, Río Vaupés, *Schultes & Cabrera 19414.* BRAZIL. Prope flumen Japurá, Amazonas, *Martius* (holotype of *R.*

martianum). PERU. Loreto: near Rioja, *Weberbauer 4695* (holotype of *R. angustiflorum*).

4. **Retiniphyllum pilosum** (Spruce ex Bth.) M. Arg. in Mart. Fl. Bras. **6**(5): 7. 1881. Fig. 34, C, C′.

Commianthus pilosus Spruce ex Benth. in Hook. Jour. Bot. 5: 233. 1853.

Type. In silvis Caatingas prope Sao Gabriel da Cachoeira, ad Rio Negro, Brazil, Jan–Aug 1852, *R. Spruce 2243* (holotype K, isotype NY).

Distribution. A small white- to greenish-white-flowered shrub bordering savannas or at the edge of the forest in drainage of Rio Negro and Río Guainía of Brazil and Venezuela. VENEZUELA. Amazonas: Forest edge at Yavita, Río Atabapo, *Maguire 29301;* edge of sabanita 1 km east of Maroa, Río Guainía, *Wurdack & Adderley 43270;* same locality, *Maguire, Wurdack & Keith 41742;* rastrojos, Maroa, *Williams 14432*. BRAZIL. Amazonas: Jucabi (at mouth of Río Cucicuriari) and vicinity, Rio Negro, *Schultes & Lopez 9633;* prope Sao Gabriel da Cachoeira, *Spruce 2243* (holotype).

5. **Retiniphyllum secundiflorum** Humb. & Bonpl. Pl. Aequin. **1**: 86. *pl. 25*. 1806. Fig. 34, D–D″.

Nonatelia secundiflora Spreng. Syst. Veg. **1**: 751. 1825.

Type. San Baltazar, in the region of the Orinoco and Atabapo rivers, Amazonas, Venezuela, *Humboldt & Bonpland* (photo from B at F).

Distribution. Shrub or small tree with deep pink or rose-colored flowers of wet, usually periodically inundated savannas and riverine forest bordering the drainage of the Río Guainía, Río Casiquiare, and Río Vaupés of Amazonas, Venezuela, and Brazil. VENEZUELA. Pantano cerca de Santa Cruz, margen del Río Atabapo, cerca de la boca del Río Atacavi, *Foldats 3628;* ad flumina Casiquiare, Vasiva et Pacimoni, *Spruce 3413;* Río Atabapo, 15 km above San Fernando de Atabapo, *Maguire 29262;* sand flat in savanna on left bank of Caño Hechimoni, Río Siapa, Casiquiare, *Maguire, Wurdack & Bunting 37626, 37667;* margin of clearing along Río Casiquiare 300 m below mouth of Río Pacimoni, *Maguire & Wurdack 35726;* Caño Pimichin, below Pimichin, Río Guainía, *Maguire & Wurdack 35607;* Río Guainía, sabanita 1 km W of La Ceiba, Caño San Miguel, 2 km above Limoncito, *Maguire, Wurdack & Keith 41914;* margins of Sabana Cumare on right bank of Caño Cumare, 20 km above San Fernando de Atabapo, *Wurdack & Adderley 42754;* Piedra Caribe, Casiquiare, *Vareschi & Magdefrau 6677A;* Caño Guarichi, Casiquiare, *Vareschi & Magdefrau 6704;* Maroa, Guainía, *Williams 14320;* sabanetas periodicamente anegadas, Yavita, *Williams 14043;* selvas ribereñas periodicamente anegadas del Caño San Miguel, Guainía, *Williams 14885*. BRAZIL. In silvula ''Catinga'' prope Igarapé Jurupary affluente Río Vaupés inferiore, Amazonas, *Ducke 222* (Yale no. 31949).

6. **Retiniphyllum fuchsioides** Krause, Verh. Bot. Ver. Brandenb. **50**: 101. 1908. Fig. 34, E–E″.

Type. Cerro de Escalero, Dept. Loreto, Peru, at alt. 1100 m, *Ule 6544* (photo from B at F).

Distribution. A small tree with red to lilac-rose-colored flowers in forests of the department of Loreto, Peru, at alt. 600–1200 m. In addition to the type specimen, the following belong here: Pumayacu, between Balsapuerto and Moyobamba, *Klug 3168* (US); prope Tarapoto, *Spruce 4254.* The Spruce specimen was labeled "*Retiniphyllum peruvianum* Spruce, sp. nov." but the name was never published.

7. **Retiniphyllum laxiflorum** (Benth.) N. E. Brown, Trans. Linn. Soc. II. **6**: 36. *pl. 6.* 1901.

Key to the Varieties of *Retiniphyllum laxiflorum*

1. Corolla-lobes 10–10.5 mm long; reticulum of tertiary veinlets on lower leaf surface unequal, the more prominent tertiary veins forming a loose open reticulum. var. *brasiliense.*
1. Corolla-lobes 11–20 mm long; reticulum of tertiary veinlets on lower leaf surface more or less equally and prominently conspicuous, the resulting reticulum of a finer pattern.
2. Corolla-lobes 11–16 mm long, shorter than the corolla-tube. var. *laxiflorum.*
2. Corolla-lobes 17–20 mm long, equaling to shorter than the corolla-tube. var. *longilobum.*

7a. **Retiniphyllum laxiflorum** (Benth.) N. E. Brown var. **laxiflorum**. Fig. 34, F–F″.

Patima laxiflora Benth. in Hook. Jour. Bot. 3: 220. 1841.
Synisoon schomburgkianum Baill. Bull. Soc. Linn. Paris 208. 1879, type: British Guiana, *Rich. Schomburgk 875* (photo from B at NY).

Type. Roraima, "British Guiana," *Rob. Schomburgk 724* (815 b) (K).

Distribution. A red or rose-colored shrub or small tree of upland savanna and sandstone table mountains in Suriname (Tafelberg), British Guiana (Pakaraima Mountains, Roraima), and Venezuela, at alt. 495–1500 m. SURINAME. Tafelberg, *Maguire 24373, 24439, 24786.* BRITISH GUIANA. Margins of Chimapu Savanna, southern Pakaraima Mountains, *Maguire, Maguire & Wilson-Browne 46151-A;* woodland edge, Kamarang River crossing, Kamarang Head, *Maguire 33260;* Arabapu Creek bank edging the savannah, southern Roraima, Forest Dept. Record No. *7931; Richard Schomburgk 875* (photo of type of *Synisoon schomburgkianum*). VENEZUELA. Estado Bolívar: Mount Roraima district, vicinity of Arabupu, *Pinkus 44;* Mount Roraima, Philipp Camp, *Tate 318;* Kavanayen, sabanas de Mandapai, *Lasser 1799;* wooded slopes, Quebrada O-paru-má, between Santa Teresita de Kavanayen and Río Pacairao, *Steyermark 60353;* Gran Sabana, Yarí, *Tamayo 3131;* valle Urimán, Río Purpur, alto Caroni, *Cardona 2593;* teraza de Guayaraca, bosque pequeño, Auyan-tepui, *Vareschi & Foldats 4662;* woodland, Ilu-tepui, *Maguire 33209;* Río Sarven, slopes and talus forest, Sarvén-tepui, Chimantá Massif, *Wurdack 34340.* Territorio Federal Amazonas: Cerro Yaví, *K. D. Phelps & Hitchcock 10;* summit, Cerro de la Neblina, west escarpment slopes east of Cumbre Camp, *Maguire, Wurdack & Maguire 42229;* Cerro Yapacana, *Maguire, Cowan & Wurdack 30626;* Cerro Sipapo, *Maguire & Politi 27925, 28515, 28707;* Cerro Yutaje, left fork of Caño Yutaje, *Maguire & Maguire 35241;* forest between Campo Verado and Campo Perez, Cerro Guanay, *Maguire, K. D. Phelps, Hitchcock & Budowski 31645;* scrub forest, sandstone dome on right bank of Río Siapo just below Raudal Gallineta, *Wurdack & Adderley 43551.*

7b. **Retiniphyllum laxiflorum** var. **longilobum** Steyermark, var. nov.

A var. *laxiflorum* differt lobis corollae 17–20 mm longis tubum corollae aequantibus vel brevioribus.

Type. Forest along north escarpment, Cerro Sipapo (Paráque), Amazonas, Venezuela, at alt. 1400 m. 23 Dec 1948, *Bassett Maguire & Louis Politi 27869* (holotype NY).

Paratypes. VENEZUELA. Amazonas: along left fork of Caño Yutaje, Cerro Yutaje, at alt. 1250 m, *Maguire & Maguire 35184, 35414;* opening along Cuao Creek, Río Orinoco, at alt. 125 m, *Maguire & Politi 27471.*

7c. **Retiniphyllum laxiflorum** var. **brasiliense** Steyermark, var. nov.

A var. *laxiflorum* differt lobis corollae 10–10.5 mm longis atque venulis tertiariis subtus inaequaliter prominulis, rete magis laxiori majorique.

Type. Gorge of Zesuserra, Serra Sincora, Estado Bahía, Brazil, at alt. 1000 m, 9 Oct 1942, *B. A. Krukoff 3* (holotype NY).

The variation of the length of the corolla-lobes in *R. laxiflorum* breaks into a measureable pattern, as given in the key to the varieties, although there is some intergradation. While most of the material of var. *laxiflorum* has the apices of the leaf-blades rounded to obtuse, some of the specimens have subacute apices. There is also some variation in pubescence of the style, length of the filaments, and size of the fruits, but these cannot be correlated with other differences.

8. **Retiniphyllum pauciflorum** Kunth ex Krause, Bot. Jahrb. Engl. **40**: 326. 1908. Fig. 34, G–G″.

Type. Near San Baltazar on the Río Atabapo, Amazonas, Venezuela, May, *Humboldt 934* (photo and fragment from B at F).

Distribution. Pink- to pale red-flowered shrub of periodically inundated savannas in drainage of Río Guainía and Río Casiquiare, Amazonas, southwestern Venezuela, at alt. 100–150 m. VENEZUELA. Savanna on left bank of Caño Hechimoni, 8 km above mouth, Río Siapa, Casiquiare, *Maguire, Wurdack & Bunting 37634;* sabanita 1 km W of La Ceiba, Caño San Miguel, 2 km above Limoncito, Río Guainía, *Maguire, Wurdack & Keith 41892;* margins of Sabana Cumare on right bank of Caño Cumare, 20 km above San Fernando de Atabapo, Río Atabapo, *Wurdack & Adderley 42752;* margenes y sabanas periodicamente anegadas, Yavita, *Williams 14044;* region central del Río Atacavi, *Foldats 3789;* Santa Cruz, margen del Río Atabapo, cerca de la desembocadura del Río Atacavi, *Foldats 3853;* prope San Balthasar ad Río Atabapo, *Humboldt 934* (photo of type from B at F, NY).

9. **Retiniphyllum scabrum** Benth. in Hook. Jour. Bot. **3**: 222. 1841.

Key to the Varieties of *Retiniphyllum scabrum*

1. Calyx truncate and at most repand-denticulate at apex. var. *ayangannense.*
1. Calyx with definite ovate to broadly triangular teeth or lobes 0.75–2 mm long.
    2. Lower surface of leaf-blades mainly glabrous, the tertiary veinlets, if pubescent, with non-strumose hairs; leaf-blades of fertile shoots mainly ovate-oblong or oval to oblong, only slightly longer than broad, 1-1/2–2 times as long as broad; pedicels 1–2.5 mm long; calyx-lobes 0.75 mm long; plants of Territorio Federal Amazonas, Venezuela. var. *erythranthum.*
    2. Lower surface of leaf-blades mostly abundantly hirsute, the hairs usually strumose; leaf-blades of fertile shoots mainly lanceolate- to elliptic- or obovate-oblong, usually conspicuously longer than broad, up to 2-3/8 times as long as broad; pedicels 2–7 mm long; calyx-lobes 0.75–2 mm long; plants of Estado Bolívar, Venezuela, and British Guiana. var. *scabrum.*

9a. Retiniphyllum scabrum Benth. var. **scabrum.**

Type. Between Roraima and Esmeralda, Venezuela, *Rob. Schomburgk* (holotype K).

Distribution. Red-flowered shrub of scrub forest and savanna margins on sandstone table mountains and plateaus of Estado Bolívar, Venezuela, and adjacent British Guiana, at alt. 750–2300 m. BRITISH GUIANA. Ayanganna Plateau, Upper Mazaruni River basin, *S. S. & C. L. Tillett & R. Boyan 44916.* VENEZUELA. Estado Bolívar: bosques de *Bonnetia* en la cumbre del Cerro Apácara, *Cardona 1541; Bonnetia* forest, northwestern part of summit of Abácapa-tepuí, Chimantá Massif, *Steyermark 74950;* cumbre de Uaipán, *K. D. Phelps 385;* Cerro Uaipán, *Cardona 2066, 2396;* summit, Mount Auyán-tepuí, *Cardona 213;* parte central del plató de Auyán-tepuí, *Foldats 2628;* dwarf forest above Fila de la Danta, between Luepa and Cerro Venamo, *Steyermark & Nilsson 300;* northwest slopes, dwarf forest, Cerro Venamo, *Steyermark & Nilsson 156;* Caño Mojado east of north escarpment above upper falls, Toronotepuí, Chimantá Massif, *Steyermark & Wurdack 989;* altiplanicie pantanosa de faldas inferiores del Aprada-tepuí, *Bernardi 800;* southwest slope forest and savannas, Ptari-tepuí, *Maguire & Wurdack 33914;* thickets on Mesa Grande, Ili-tepui, *Maguire 33345, 33325A;* lower slope forest, Ilu-tepuí, *Maguire 33249.*

The name *R. scabrum* Benth. has been neglected since 1841. It is obvious that the plants of the Gran Sabana of Estado Bolívar, Venezuela match the description of Bentham and must replace the name of *R. erythranthum* Standl., previously used for the plants of the Gran Sabana. An examination of type material of *R. erythranthum* Standl. from Cerro Duida, Territorio Amazonas, Venezuela, shows that it is not conspecific with *R. scabrum*, but can be separated from the latter at least varietally. In describing *R. erythranthum,* Standley was apparently unable to see the resemblance existing between the plants from Cerro Duida and the *Schomburgk* specimen of *R. scabrum,* and in his treatment of Rubiaceae of Venezuela (Field Mus. Bot. Ser. **7**: 401. 1931) placed the name in alphabetical order without being able to match it with anything known from Venezuela.

Obvious differences exist between typical *R. scabrum* Benth. of Estado Bolívar, eastern Venezuela, and *R. erythranthum* Standl. of Cerro Duida and other cerros of Territorio Federal Amazonas, western Venezuela. In *R. scabrum* var. *scabrum* the leaf-blades of the fertile shoots are elliptic- or obovate- to lanceolate-oblong and abundantly scabrid-hirsutulous on the lower surface, and the calyx-lobes are 0.75–2 mm long. On the other hand, the plants of Cerro Duida and other cerros of Territorio Federal Amazonas, which fit Standley's description of *R. erythranthum,* have the leaf-blades of the fertile shoots more oval or broadly elliptic-ovate with the lower leaf surface usually glabrous or with less abundant trichomes, which are not strumose nor scabrid, and the calyx-lobes are only 0.75 mm long. Moreover, the plants of *R. erythranthum* have nearly sessile or only shortly pedicellate flowers with pedicels only 1–2.5 mm long, whereas the pedicels in typical *R. scabrum* are 2–7 mm long. Finally, it is to be noted that plants from Mount Ayanganna, British Guiana, represent still another departure from typical *R. scabrum,* as well as from *R. erythranthum,* in having a truncate, merely repand-denticulate summit of the calyx, instead of ovate or broadly triangular calyx teeth or lobes of the other taxa. The shape of the leaf-blades of the plants from Mount Ayanganna, as well as their type of pubescence, resemble most closely those of typical *R. scabrum.*

A close study of all this material has led to the present interpretation in treating this complex as consisting of three varieties, as delimited in the key under *R. scabrum.*

9b. Retiniphyllum scabrum Benth. var. **erythranthum** (Standl.) Steyermark, stat. nov. Fig. 34, H. H′.

R. erythranthum Standl. in Field Mus. Bot. Ser. 7: 399. 1931, type: slopes at Central Camp, summit, Cerro Duida, Amazonas, Venezuela, at alt. 1455 m, 28 Dec–1 Jan 1929, *G. H. H. Tate 561* (holotype NY).

Distribution. Sandstone table-mountains of Territorio Federal Amazonas, western Venezuela, at alt. 1300–2000 m. VENEZUELA. Cerro Duida, *Tate 561* (holotype of *R. erythranthum*)*;* Savanna Hills, summit of Cerro Duida, *Tate 756* (paratype of *R. erythranthum*)*;* summit of Cerro Duida, *Tate 465* (paratype of *R. erythranthum*)*;* Cerro Duida, *Maguire, Cowan & Wurdack 29598, 29617;* summit, Cerro Duida, along valley forest between Central Camp and Brocchinia Hills, *Steyermark 58129;* southeastern-facing slopes along Caño Negro, Cerro Duida, *Steyermark 58034;* Serrania Parú, *Cowan & Wurdack 31105, 31147, 31232.*

9c. Retiniphyllum scabrum Benth. var. **ayangannense** Steyermark, var. nov. Fig. 34, I, I′.

A var. *scabrum* differt calyce apice subtruncato vel repando-denticulato; laminis foliorum ovali-oblongis vel oblongis apice rotundatis vel late obtusis basi rotundatis vel fere subcordatis 3–7 cm longis 1.6–2.5 cm latis, supra costa media subsulcata sparse strigillosa ceterum glabris, subtus dense pilis strumosis asperulo-hirsutis instrucits; floribus terminalibus 4–5-fasciculatis subsessilibus, pedicellis 1–3 mm longis; corollae tubo 28–29 mm longo, lobis 10–11 mm longis 5.25–6 mm latis.

Type. Scrub and low forest on shoulder of east flank, Mount Ayanganna, above Thompson Camp, at alt. 1370–1525 m, 8 Aug 1960, *Stephen S. & Carolyn L. Tillett & Rufas Boyan 45194* (holotype NY).

Some intergradations are found between var. *scabrum* and var. *erythranthum.* Among these may be cited *Maguire, Steyermark & Maguire 46830* from Estado Bolívar, Venezuela with sparsely pubescent lower leaf surface, *Cardona 2636* from Estado Bolívar, Venezuela, with a leaf shape similar to var. *erythranthum,* and *Tillett, Tillett & Boyan 44916* from British Guiana, which resembles var. *erythranthum* in the sparsely pubescent lower leaf surface.

A specimen which appears to represent a hybrid between *Retiniphyllum laxiflorum* and *R. scabrum* is *Steyermark 59463* from Ptari-tepuí, Estado Bolívar, Venezuela. In this collection the leaves are reticulate-nerved with the shape and texture as in *R. laxiflorum,* but the midrib of the lower leaf surface as well as parts of the lower surface are sparsely appressed-strigose. Also, the young or apical part of the stem is densely scabridulous or strigose, while the petioles are sparsely so. The 3–4 flowers are subfasciculate on pedicels 3–6 mm long, suggesting *R. scabrum* var. *scabrum,* but are slender, as in *R. laxiflorum.* The corolla-lobes, which are shorter than the corolla-tube, agree in this respect with those of *R. scabrum* var. *scabrum,* with measurements of 22–24 mm long for the corolla-tube (as compared with 25–29 mm in *R. scabrum* and 16–24 mm in *R. laxiflorum*) and 11–12 mm long for the corolla-lobes (as compared with 9–11 mm in *R. scabrum* and 10–20 mm in *R. laxiflorum*); the measurements thus show a somewhat intermediate condition between those of *R. scabrum* and *R. laxiflorum*. As regards the calyx-tube and hypanthium of the apparent hybrid, the length of the two combined (9–10 mm) approaches that of *R. scabrum* (with a combined length of 9–12 mm of the calyx and hypanthium) more closely than that of *R. laxiflorum* (with a length of 6–9 mm), although here again it is somewhat intermediate. The puberulent upper half of the calyx in the presumed hybrid specimen resembles more closely that found in *R. laxiflorum* than in that of *R. scabrum*, in which the calyx is densely hirtellous. Also, the more subtruncate, repand-denticulate summit of the calyx in the *Steyermark 59463* collection suggests *R. laxiflorum* more than the usually toothed type found in *R. scabrum* (except var. *ayangannense*). In general, it may be stated that the vegetative aspect of this supposed hybrid plant is that of *R. laxiflorum*, but that the floral details resemble *R. scabrum* in some respects and *R. laxiflorum* in other details. The type of inflorescence suggests that of *R. scabrum*, but the delicate pedicels resemble those of *R. laxiflorum*.

10. Retiniphyllum cearense Standl. Field Mus. Bot. Ser. **17**: 220. 1937.

Type. Province de Ceará, Brazil, 1838, *Gardner 156* (holotype Delessert Herb.).

Distribution. Known only from the type collection.

11. Retiniphyllum cataractae Ducke, Archiv. Inst. Biol. Veg. Rio Janeiro **4**: 62. 1938. Fig. 34, J–J″.

Type. In silvula "catinga" secus cataractam Cajú, Rio Cucicuriary affluente Rio Negro, Amazonas, Brazil, 21 Feb 1936, *A. Ducke 35067* (holotype RB, isotype NY).

12. Retiniphyllum tepuiense Steyermark, sp. nov. Fig. 31, A–G. Fig. 34, K–K″.

Frutex vel arbuscula ad 8-metralis, ramis novellis scabridulis; stipulis 3 mm longis apice truncatis scabridulis; foliis petiolatis, petiolis 7–13 mm longis sparse minuteque scabridulis vel supremis magis dense scabridulis; laminis oblanceolatis vel elliptico-oblongis vel oblongo-oblanceolatis vel oblongis apice rotundatis vel obtusis basi subacutis vel acutis 5–9 cm longis 1.7–3.5 cm latis, supra glabris costa media subsulcata, subtus costa media minute sparseque scabridula vel glabrata, ceterum praesertim glabris, marginibus paullo revolutis minute scabridulis, utrinque venulis tertiariis laxe reticulatis; nervis lateralibus utroque latere 9–11; inflorescentia racemosa 4.8–11.5 cm longa 15–17-flora terminali 0.6–2.5 cm longe pedunculata, rhachi minute asperula vel scabridula 2–2.5 mm diam; floribus pedicellatis oppositis vel inferioribus medianisque 3–4-subverticillatis, pedicellis 2.5–7 mm longis 1–1.5 mm crassis sparse vel moderate minuteque scabridulis; involucello disciformi 0.7–0.8 mm longo apice 2 mm lato margine apicis dense tuberculis minutissimis resinosis tuberculato instructo minute sparseque scabridulo; calyce tubuloso 5–7 mm longo apice 3–3.5 mm lato apice repando-denticulato modice vel dense scabridulo; corolla albida vel viridi-albida interdum pallido-rosea suffusa hypocrateriformi 16–17 mm longa, tubo 7.5 mm longo basi 2.25–2.5 mm lato fauce 4 mm lato extus cinereo-sericeo parte basilari 3 mm glabra excepta, intus supra medium (3/4–7/8 longitudinis) annulo pilorum barbatorum instructo supra annulum usque ad faucem 3 mm pubescenti infra

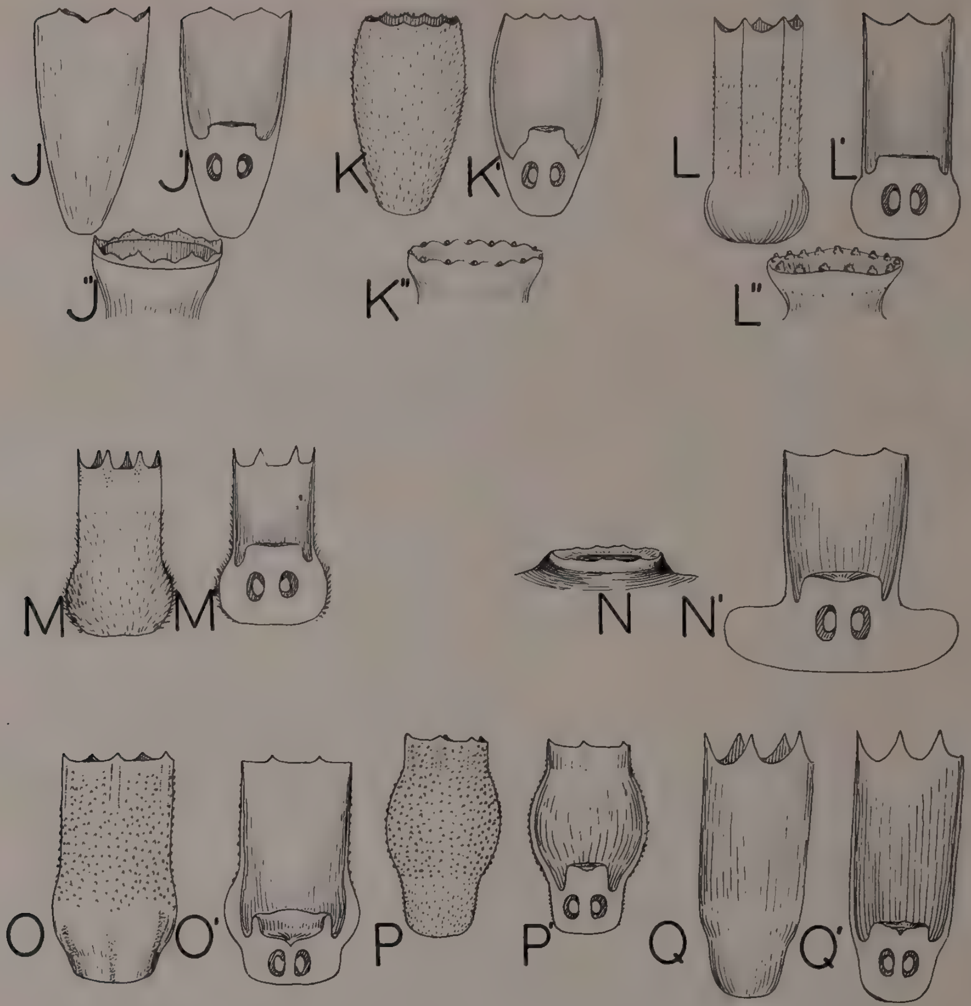

FIG. 34 (cont'd). J–J", *R. cataractae.* J, calyx and hypanthium, exterior view, × 4. J', vertical section of J, × 4. J", involucel, × 14. K–K", *R. tepuiense.* K, calyx and hypanthium, × 4. K', vertical section of K, × 4. K", involucel, × 10. L–L", *R. maguirei* var. *reticulatum.* L, calyx and hypanthium, exterior view, × 4. L', vertical section of L, × 4. L", involucel, × 10. M–M', *R. schomburgkii* subsp. *schomburgkii.* M, calyx and hypanthium, × 4. M', vertical section of M, × 4. N–N', *R. truncatum* var. *truncatum,* N, involucel, × 6. N', calyx and hypanthium, vertical section, × 7. O–O', *R. speciosum.* O, calyx and hypanthium, exterior view, × 3. O', vertical section of O, × 3. P–P', *R. speciosum* (*R. rhabdocalyx, Froes 21341*). P, calyx and hypanthium, × 3. P', vertical section of P. Q–Q', *R. glabrum.* Q, calyx and hypanthium, exterior view, × 4. Q', vertical section of Q, × 4.

annulum ad basin 4.5–5 mm glabro, lobis lineari- vel ligulato-oblongis apice rotundatis 9–9.5 mm longis 3.5–4 mm latis tubum longioribus utrinque cinereo-sericeis; antheris 3.6–3.7 mm longis loculis 2 mm longis connectivo in acumen 0.8–1 mm longum producto basi appendice oblongo 1 mm longo 0.7 mm lato instructo; filamentis 5.5 mm longis 1 mm latis strigilloso-sericeis; stylo 14–15 mm longo supra medium pubescenti parte infima 6.5 mm glabra deinde piloso pilis patentibus instructo; fructu subgloboso, pyrenis 8–9 mm longis 7–8 mm latis prominente 5-angulatis.

Type. Shrub 2–3 m; flowers whitish; along water course, upper East Basin, Cerro Sipapo (Paráque), Amazonas, Venezuela, at alt. 1600–1800 m, 20 Jan 1949, *Bassett Maguire & Louis Politi 28458* (holotype NY). Paratypes. Cerro Sipapo (Paráque), *Maguire & Politi 27578, 27680, 27784, 27870;* summit, Cerro de la Neblina, *Maguire, Wurdack & Bunting 37030, 37163, 42129.*

This species is thus far known only from two sandstone table mountains (Cerro Sipapo and Cerro de la Neblina) in the Territorio Federal Amazonas, Venezuela, where it occurs in scrub forest at alt. 1500–1900 m.

13. **Retiniphyllum maguirei** Standley, Bull. Torrey Club **75**: 571. 1948, emendavit Steyermark.

Foliorum laminae utrinque prominente reticulatae vel haud reticulatae vel subtus paullo reticulatae; pedicellis 1–7 mm longis; calyce 6–9 mm longo apice truncato appendicibus minutis instructo vel dentato dentibus triangularibus 0.75 mm longis instructo extus fere glabro vel puberulo.

Key to the Varieties of *Retiniphyllum maguirei*

1. Calyx 6–7 mm long, truncate at apex with only minute protuberances; calyx nearly glabrous externally; upper leaf surface not at all or inconspicuously reticulate, lower surface only slightly so; pedicels 2–7 mm long. var. *maguirei.*
1. Calyx 8.5–9 mm long, with triangular lobes 0.75 mm long; calyx puberulous externally; upper and lower leaf surface prominently reticulate; pedicels 1–4.5 mm long. var. *reticulatum.*

13a. **Retiniphyllum maguirei** Standl. var. **maguirei.**

Type. Savanna No. 4, Tafelberg, Suriname, at alt. 552 m, 15 Aug 1944, *Bassett Maguire 24374* (holotype F, isotype VEN). Paratype. Shallow bogs on Savanna no. 1, vicinity of Camp no. 1, Tafelberg, 3 Aug 1944, *Maguire 24220* (F, NY, VEN).

Distribution. Known only from Tafelberg, Suriname.

13b. **Retiniphyllum maguirei** var. **reticulatum** Steyermark, var. nov. Fig. 34, L–L″.

A var. *maguirei* differt foliorum laminis utrinque prominente reticulatis; pedicellis 1–4.5 mm longis; calyce 8.5–9 mm longo extus puberulo apice dentibus triangularibus 0.75 mm longis instructo.

Type. Savanna No. 1, Tafelberg, Suriname, at alt. 565 m, 13 Aug 1944, *Bassett Maguire 24361* (holotype VEN, isotype NY). Paratypes. Savanna No. 7, Tafelberg, at alt. 495 m, 17 Sep 1944, *Maguire 24787;* Savanna No. 4, Tafelberg, at alt. 552 m, 15 Aug 1944, *Maguire 24374* as to NY sheet only.

In the original description of *R. maguirei,* Standley indicated the possible hybrid origin of this taxon. Unfortunately, the holotype and paratype material included by Standley represent a mixture of variations, the NY sheet of *Maguire 24374* representing one variation and the F and VEN sheets of the same number representing another variation. As two variations are represented by Standley's citations of specimens and are included in his description, it has been necessary to emend the original description to include both variations, and to restrict the typical variation to the *Maguire 24374* sheets at F and VEN, and to all the *Maguire 24220* specimens examined, since most of Standley's original description applies to these sheets. Standley's description of the calyx in the original description fits the paratype sheet of *Maguire 24220*, but does not apply to the NY sheet of *Maguire 24374*, included as an isotype by Standley. The holotype sheet of *Maguire 24374* at F and the isotype of this number at VEN, together with the paratype specimens of *Maguire 24220*, constitute the basis for the description of var. *maguirei*.

The collections of *Maguire 24361* and *24787* were originally labelled by Standley as *R. schomburgkii*, and were so reported in Bull. Torrey Club **75**: 571. 1948. But, as can be seen from an examination of this material, the flowers are pedicellate, as in the other specimens of *R. maguirei*, not sessile as in *R. schomburgkii*.

It is quite possible that *R. maguirei* represents a hybrid, and is intermediate in characters between *R. schomburgkii* and *R. laxiflora*. However, the settlement of this matter will have to await future field and genetic investigations.

14. **Retiniphyllum schomburgkii** (Benth.) M. Arg. in Mart. Fl. Bras. **6**(5): 12. 1881.

Key to the Subspecies and the Varieties of *Retiniphyllum schomburgkii*

1. Calyx-tube externally hirsutulous with spreading hairs. subsp. *occidentale* var. *hirticalyx*.
1. Calyx-tube externally strigillose with appressed hairs.
  2. Base and apex of leaf-blade chiefly rounded to obtuse, rarely subacute; corolla-lobes mainly 11–14 mm long, tube mainly 8–8.5 mm long; filaments up to 9.5 mm long; plants of Territorio Federal Amazonas, Venezuela, and Estado Amazonas, Brazil. subsp. *occidentale* var. *occidentale*.
  2. Base and apex of leaf-blade chiefly acute to subacute, rarely subobtuse; corolla-lobes 9.5–10 mm long, tube 6–6.5 mm long; filaments 5.25–8 mm long; plants of Surinam, British Guiana, chiefly Estado Bolívar and rarely Territorio Federal Amazonas, Venezuela, and Estado Pará, Brazil. subsp. *schomburgkii*.

14a. **Retiniphyllum schomburgkii** (Benth.) M. Arg. subsp. **schomburgkii**. Fig. 34, M, M′.

Commianthus schomburgkii Benth. in Hook. Jour. Bot. 3: 223. 1841.

R. schomburgkii var. *angustifolium* Hub. Bull. Soc. Bot. Gen. Ser. II, 6: 209. 1915, type: arbusto da campina rana, north of Obidos near Campos de Ariramba, Alto Ariramba, state of Pará, Brazil, *A. Ducke 8022*.

Type. Savannahs in Guiana Anglica, *Rob. Schomburgk 179* (holotype K, isotype NY).

Distribution. Shrub or small tree with white to pinkish-tinged flowers in savannas, scrub forest, and semi-open woodland, British Guiana, Suriname, southern Venezuela, and state of Pará, Brazil, ascending to 2100 m on the summits of sandstone table mountains of Venezuela.

14b. **Retiniphyllum schomburgkii** subsp. **occidentale** Steyermark, subsp. nov.

A subsp. *schomburgkii* differt apice basique laminarum foliorum praesertim rotundatis vel obtusis, corollae lobis 11–14 mm longis, corollae tubo praesertim 8–8.5 mm longo, filamentis ad 9.5 mm longis.

Type. Shrub 1–2.5 m; corolla white, the throat with pink stripes between the lobes; fruit red; occasional at edge of Savanna no. 3, northwest base of Cerro Yapacana, Territorio Federal Amazonas, Venezuela, at alt. 150 m, 17 Mar 1953, *Bassett Maguire & John J. Wurdack 34531* (holotype NY). Paratypes. VENEZUELA. Territorio Federal Amazonas: sabanita at northwest base of Cerro Moriche, at alt. 150 m, *Maguire, Cowan & Wurdack 30997;* montane caño savanna along stream, Cerro Moriche, at alt. 800 m, *Maguire, Cowan & Wurdack 30901;*

Sabana de Moyo (right bank of Orinoco 10 km above mouth of Río Ventuari, at alt. 125–150 m, *Wurdack & Adderley 43703;* Sabana de Morocoto just west of Cerro Morocoto, Río Orinoco below San Fernando de Atabapo, at alt. 150 m, *Level 8;* Sabana de Moyo, *Level 32;* Esmeralda Ridge, Alto Río Orinoco, *Maguire, Wurdack & Keith 41568;* Cerro Yapacana, Savanna no. 3 at northwest base of mountain, at alt. 130 m, *Maguire, Cowan & Wurdack 30537;* Cerro Duida, north slopes and ridges of Caño Negro basin, at alt. 2000–2300 m, *Maguire, Cowan & Wurdack 29704;* Cerro Sipapo, open scrub savanna 3 km southwest of Base Camp, at alt. 200 m, *Maguire & Politi 28824;* Esmeralda Ridge, *Steyermark 57750;* Sabana de Arboles, base of Cerro Duida, *Steyermark 57903;* Esmeralda, *Tate 321;* Cerro Yapacana, *Holt & Blake 758;* prope Esmeralda, Spruce *3247;* Yavita, at alt. 128 m, *Williams 13891;* Santa Cruz, margen del Río Atabapo, cerca de la desembocadura del Río Atacavi, *Foldats 3819;* Sabana de San Antonio, Alto Orinoco, *Williams 15057, 15036;* Maroa, Guianía, en malezas, *Williams 14261;* sabanetas, San Carlos, at alt. 100 m, *Williams 14519.* BRAZIL. Estado Amazonas: caatinga entre Cachoeira das Araras, Vaupés e rio Arary, Içana, *Froes 21311;* arenosis ripariis altis, loco Quatia, Santa Izabel, Rio Negro, *Ducke 358;* prope Barra, Prov. Rio Negro, *Spruce 1777.*

14b′. Retiniphyllum schomburgkii subsp. **occidentale** var. **hirticalyx** Steyermark, var. nov.

A subsp. *occidentale* var. *occidentale* differt tubo calycis extus hirsutulo pilis patentibus onusto.

Type. Shrub 1–2.5 m; corolla white with pink throat; sabanita 0.5–1.5 km north of Puerto Colombia (opposite Maroa), Colombia, at alt. 130 m, 12 Oct 1957, *Bassett Maguire, John J. Wurdack & William Keith 41860* (holotype NY).

The two subspecies of *R. schomburgkii* are mainly geographically separated to the east (Suriname, British Guiana, and Estado Bolívar, Venezuela) and west (Colombia boundary and Territorio Federal Amazonas, Venezuela), but intergrade and sometimes are found in the same locality, as on the summit of Cerro Duida. At the last locality are encountered collections of *Maguire, Cowan & Wurdack 29810,* referred to subsp. *schomburgkii,* with cuneately acute to subacute leaf-base and subacute apex, and small corollas, and *Maguire, Cowan & Wurdack 29704,* referred to subsp. *occidentale,* with leaves more rounded at apex, rounded to subobtuse at base, and with longer corollas.

15. Retiniphyllum truncatum M. Arg. in Mart. Fl. Bras. **6**(5) : 11. 1881.

Key to the Varieties of *Retiniphyllum truncatum*

1. Leaf-blades broadly ovate, elliptic-ovate, or ovate-oblong, subacute to obtuse at base, mainly 3–7 cm broad. var. *truncatum.*
1. Leaf-blades oblanceolate to elliptic-oblanceolate, cuneately acuminate at base, 2–3.2 (rarely 4) cm broad. var. *angustifolium.*

15a. Retiniphyllum truncatum M. Arg. var. **truncatum.** Fig. 34, N, N′.

Type. Ad flumen Guainía v. Río Negro supra ostium fluminis Casiquiare, 1854, *R. Spruce 3131* (holotype K, isotype NY); inter San Carlos et Solano, October, 1853, *R. Spruce 3131* (photo from K at NY).

Distribution. Shrub with white to pink-tinged flowers of savannas and scrub forest, Territorio Federal Amazonas, Venezuela, Amazonian drainage of Colombia, and Rio Içana, Brazil generally at altitudes between 100–200 m, but ascending to 1600 m on Cerro Duida, Venezuela. VENEZUELA. Supra ostium fluminis Casiquiare, *Spruce 3131* (holotype); inter San Carlos et Solano, *Spruce 3131;* Yavita, *Lichy 6;* 1 km east of Maroa, Río Guainía, *Maguire, Wurdack & Keith 41743;* Caño Temi, Río Atabapo, *Maguire 29294;* Santa Cruz, margen del Río Atabapo, cerca de la desembocadura del Río Atacavi, *Foldats 3663;* 10 km north of Maroa, *Maguire, Wurdack & Keith 41754; Bonnetia-Byrsonima cretacea* forest near Culebra Creek, Cerro Duida, *Maguire, Cowan & Wurdack 29534, 29089;* between Esmeralda Savanna and southeastern base of Cerro Duida, *Steyermark 57818.* BRAZIL. Pé da serra, Rio Içana, *Pires 742.* COLOMBIA. Amazonas: interior regions of trapecio between Amazon and Putumayo watersheds, *Schultes 6903;* Rio Caquetá, La Pedrera and vicinity, Cerro de La Pedrera, *Schultes & Cabrera 17681, 17802.* Amazonas-Vaupés: Río Apaporis, Raudal de Jirijirimo, below mouth of Río Kananarí, *Schultes & Cabrera 13502, 14009, 14057, 14631, 14958.* Vaupés: caatinga, Rio Negro, vicinity of Piedra de Cocui, *Schultes & Cabrera 9513;* Río Piraparaná, Raudal Na-hoó-gaw-he, *Schultes & Cabrera 17112;* Río Piraparaná (tributary of Río Apaporis), Caño Teemeeña, *Schultes & Cabrera 17230, 17473;* Río Piraparaná, Cerro E-ree-eé-ko-mee-o-kee, *Schultes & Cabrera 17502;* Rio Negro, San Felipe and vicinity, below confluence of Río Guainía and Río Casiquiare, *Schultes, Baker & Cabrera 17989, 18023.*

Although the summit of the calyx was described by Müller Argoviensis as truncate and entire, an examination of isotype material at NY (*Spruce 3131*) shows the calyx with five repand-denticulate protuberances on the summit. Other collections matching the Spruce specimen likewise show the five repand-denticulations of the calyx summit.

15b. **Retiniphyllum truncatum** var. **angustifolium** Steyermark, var. nov.

A var. *truncatum* differt laminis foliorum elliptico-oblanceolatis vel oblanceolatis apice hebite acutis basi cuneatim acuminatis 2–3.2(–4) cm latis.

Type. Arbusto 2 m; Picada Cotuhé, "varial" aberto, beira de um corrego, Colombia, 8 Nov 1946, *Richard Evans Schultes & R. Black 46–357* (holotype US).

16. **Retiniphyllum kuhlmannii** Standley, Field Mus. Bot. Ser. **8**: 356. 1931.

Type. Rio Verde, Chapadão, Matto Grosso, Brazil, April 1918, *J. G. Kuhlmann 2343* (holotype RB, fragment of type at F).

Distribution. Known only from the type locality.

17. **Retiniphyllum guianense** Steyermark, sp. nov.

Frutex 2-metralis, ramis glabris; foliis petiolatis, petiolis 1.5–2 mm longis glabris; laminis elliptico-oblanceolatis vel ellipticis apice hebete subacutis angustatis basi cuneatim subacuminatis 7–13.5 cm longis 2.3–4.8 cm latis utrinque glabris, paullo revolutis, costa media supra subsulcata subtus prominula; nervis lateralibus utroque latere 10–13 subtus leviter impressis; inflorescentia spicata 4.5–6.5 cm longa, rhachi 2–2.5 mm lata resinosa glabra, 0.3 cm longe pedunculata; floribus sessilibus; involucello anguste oblongo cum ovario juncto; calyce turbinato-obconico coriaceo 7 mm longo apice 4 mm lato basi 1.75 mm lato subtruncato plus minusve paullo repando extus glabro; corolla hypocrateriformi, tubo 11 mm longo basi 3 mm lato fauce 4.25 mm lato extus cinereo-sericeo vel velutino parte basilari 3.5 mm glabra excepta, intus supra medium (5/8–2/3 longitudinis) annulo pilorum barbatorum instructo supra annulum usque ad faucem dense sericeo-strigoso infra annulum ad basin 6 mm glabro, lobis reflexis tubum fere

aequantibus vel longioribus 11–11.5 mm longis 4 mm latis lineari-oblongis apice rotundatis utrinque tomentello-sericeis; antheris lanceolatis 2.5 mm longis connectivo in acumen subulatum 0.8–0.9 mm longum producto; filamentis 6 mm longis basi 1 mm latis sparse strigillosis; fructu sessili ovoideo 10–11 mm longo 8 mm lato glabro.

Type. Shrub 2 m; leaves brittle; flowers greenish-white; fruit ovoid, red; infrequent in forest, trail along southeast side of Merume Mountain, Partang River, Upper Mazaruni Basin, British Guiana, at alt. 1140 m, 5 Jul 1960, *Stephen S. & Carolyn T. Tillett & Rufus Boyan 44824* (holotype NY).

18. **Retiniphyllum speciosum** (Spruce ex Benth.) M. Arg. in Mart. Fl. Bras. **6**(5): 10. 1881. Fig. 34, O, O′.

Commianthus speciosus Spruce ex Benth. in Hook. Jour. Bot. **5**: 234. 1853.
R. rhabdocalyx M. Arg. in Martius, Fl. Bras. **6**(5): 10. 1881, type: in campestribus montis Serra de Araracoara in ditione Japurensi, Brazil, *Martius 3148* (photo of type from M at NY). (Fig. 34, P, P′.)

Type. Prope San Gabriel da Cachoeira, ad Rio Negro, Brazil, June 1852, *R. Spruce 2340* (holotype K, isotype NY).

Distribution. Shrub or small tree with red or purplish flowers in caatinga sandy openings, and border of forest in drainage of Río Negro and Amazon, Amazonas, Brazil. Arary pirá, Rio Arary, região Rio Negro, *Froes 21341;* Serra de Araracoara in ditione Japurensi, *Martius 3148* (type of *R. rhabdocalyx*)*;* prope San Gabriel da Cachoeira, ad Rio Negro, *Spruce 2340* (type of *R. speciosum*)*;* caatinga proximo a Serra dos Tucanos, Rio Uaupés, *Pires 864;* Manáos, Rio Tarumá-miry, silva ad marginem campinae arenosae, *Ducke 789;* caatinga circa cataractam Cajú, Rio Curicuriary, affluente Rio Negro superiore, *Ducke 24020;* Upper Rio Negro, *Weiss & Schmidt s.n.;* Serra Wabeesee, left bank Rio Vaupes below Bela Vista, between Ipanoré and confluence with Rio Negro, *Schultes & Pires 9139.*

The isotype of *R. speciosum* shows the ribbing on the calyx as in *R. rhabdocalyx* and the length of the corolla-lobes in proportion to that of the corolla-tube (in *R. rhabdocalyx* stated by M. Arg. to be 2–3 times shorter on the lobes with respect to the corolla-tube) approximates that of *R. rhabdocalyx.*

19. **Retiniphyllum glabrum** Steyermark, sp. nov. Fig. 34, Q, Q′.

Frutex; foliis petiolatis, petiolis 6–10 mm longis glabris; laminis anguste ellipticis vel elliptico-lanceolatis apice acutis vel subacuminatis rariter subobtusis basi cuneatim acuminatis vel acutis 5–7 cm longis 1.7–2.3 cm latis utrinque glabris, supra costa media subsulcata, subtus paullo elevata; nervis lateralibus utroque latere 11–12 fere obsoletis, venulis tertiariis supra laxe reticulatis, inflorescentia spicata 6–10.5 cm longa, 6–22 mm longe pedunculata, 8–12-flora, floribus sessilibus oppositis 4–6-jugis inter eos 15–27 mm distantibus dispositis; rhachi 1.5–2 mm lata glabra; involucello cupulato lineari-oblongo 4 mm longo 1.5 mm lato apice subundulato; calyce hypanthioque tubuloso 9 mm longo apice 3 mm lato basi 2.5 mm lato glabro; calyce 5-dentato, dentibus anguste triangulari-subulatis 1.25–1.5 mm longis 0.3–0.4 mm latis; corolla hypocrateriformi, tubo lobis longiori 20 mm longo basi 1.5 mm lato fauce 3 mm lato extus sericeo-strigilloso parte basilari 3 mm glabra excepta, intus parte basilari 3 mm glabra supra basin 3–4 mm annulo pilorum barbatorum instructo deinde supra annulum ad faucem breviter strigilloso, lobis linearibus 16–17 mm longis 2–5 mm latis utrin-

que cinereo-tomentellis; antheris 3.25 mm longis loculis 2.2 mm longis connectivo in acumen acuminatum subulatum fere 1 mm longum producto basi appendice 0.5 mm longo instructo; filamentis 5.5–6 mm longis modice pilosis; stylo 30 mm longo glabro vel glabrato; fructu immaturo 13 mm longo 6.5–7 mm lato 5-carinato.

Type. Bushy; flowers red; Ipanoré, Rio Vaupes, between Ipanoré and confluence with Rio Negro, Amazonas, Brazil, 14–15 Nov 1947, *Richard Evans Schultes & João Murça Pires 9100* (holotype US). Paratype. Low bush; flowers red; Igarapé da Chuva, Taracuá, Rio Vaupes, between Ipanoré and confluence with Rio Negro, 12 Nov 1947, Amazonas, Brazil, *Schultes & Pires 9073* (US).

This species is related to *R. discolor* (Spruce ex Benth.) M. Arg. and *R. pallidum* M. Arg. From the latter species it differs in the longer calyx and the corolla-lobes shorter than the corolla-tube. From *R. discolor* it differs in the concolorous, narrower, differently shaped leaf-blades, longer corolla-tube and lobes, and longer, more triangular-shaped calyx-lobes.

20. **Retiniphyllum pallidum** M. Arg. in Martius, Fl. Bras. **6**(5): 12. 1881.

Type. In silvis Serrae de Cupati, in ditione Rio Negro, Alto Amazonas, Brazil, *Martius.*

Distribution. Known only from the type collection.

21. **Retiniphyllum discolor** (Spruce ex Benth.) M. Arg. in Mart. Fl. Bras. **6**(5): 11. 1881.

Commianthus discolor Spruce ex Benth. in Hook. Jour. Bot. 5: 234, 1853.

Type. In campis inundatis vico Uananança oppositis inter Barcellos et Sao Gabriel, ad Rio Negro, Amazonas, Brazil, *R. Spruce 2010* (cited in Fl. Bras. as no. *2063*) (holotype K, isotype NY, photo of type from M at NY).

Distribution. Known only from the type collection.

Excluded Species

Retiniphyllum adinanthum Standl. Field Mus. Bot. Ser. **8**: 355. 1931. = **Stachyococcus adinanthus** (Standl.) Standl. Field Mus. Bot. Ser. **13**: 144. 1936.

Type. Near Iquitos, Mishuyacu, Dept. Loreto, at alt. 100 m, Feb–Mar 1930, *G. Klug 988* (holotype F, isotype NY).

Tribe Guettardeae

Malanea Aublet, Hist. Pl. Guiane Fr. **1**: 106. *t. 41.* 1775.

Type species. *M. sarmentosa* Aubl.

A genus mainly comprising lianas, but in a few cases collectors have recorded plants as shrubs or trees. *Malanea* is confined to tropical South America, especially to the northern half, and Trinidad.

Key to the Species of *Malanea* of Guayana and adjacent Brazil, including all Venezuelan and West Indian Species

1. Upper leaf surface pilose or hirsute with few to numerous spreading hairs 1–1.7 mm long.
   2. Calyx portion above hypanthium hirsutulous externally with spreading hairs; leaf-blades mainly acute to subacute at base; hairs on lower leaf surface dense, up to 1.5 mm long; upper leaf surface moderately to abundantly hirsutulous; fruiting rachis 3–5.5 cm long, the fruiting peduncle 1.5–3 cm long. 1. *M. hirsuta.*

2. Calyx portion above hypanthium appressed-pubescent externally; leaf-blades mainly obtuse to rounded at base; hairs on lower leaf surface sparse to moderate, shorter, mainly 0.5–1 mm long; upper leaf surface sparsely and remotely hirsutulous; fruiting rachis 6.5–10.5 cm long, the fruiting peduncle 3–5 cm long. 2. *M. fendleri.*

1. Upper leaf surface glabrous or with appressed strigillose hairs less than 0.5 mm long.

3. Lower leaf surface gray-silvery with moderate to dense tomentum.

4. Leaf-blades 2.2–5(–6.5) cm long, 1.2–3.3(–4) cm broad, acute or subacute at base; inflorescence 0.8–1(–2.9) cm long, none of flower clusters on lateral branches; peduncle 0.3–0.6 cm long; filaments none or barely evident. 6. *M. tafelbergensis.*

4. Leaf-blades 7–12.5 cm long, 4–9 cm broad, obtuse to rounded at base; inflorescence 3.5–5.5 cm long, 1 or 2 of the flower clusters on lateral branches; peduncle 1.5–2 cm long; filaments 0.5–0.6 mm long.

5. Style pubescent in lower half; calyx portion above hypanthium moderately strigillose with short hairs externally, the lobes shallow repand-undulate. 5. *M. hypoleuca.*

5. Style glabrous throughout; calyx portion above hypanthium glabrous or glabrate, subtruncate. 4. *M. macrophylla.*

3. Lower leaf surface glabrous or pubescent, but not gray-silvery-pubescent.

6. Leaf-blades 1.7–3.3 cm long; lateral nerves of leaf-blades 4–5; calyx-lobes 1–1.5 mm long, higher than broad; bracts at base of flowers glabrous or nearly so, decussate in 2 separated erect, appressed pairs. 25. *M. microphylla.*

6. Leaf-blades 5–16 or more cm long; lateral nerves of leaf-blades 5–13; calyx-lobes, if developed, less than 0.7 mm long, broader than high or not higher than broad; bracts at base of flowers crowded, proximate, spreading, not separated nor decussate.

7. Leaf-blades, including the midrib and nerves, glabrous both sides.

8. Lateral pairs of nerves of leaf-blades 7–9 on each side, impressed or obscurely sulcate above; leaf-margins plane to subrevolute; corolla 3.5–4.2 mm long. 23. *M. obovata.*

8. Lateral pairs of nerves of leaf-blades (8–)9–11 on each side, conspicuously sulcate above; leaf-margins usually conspicuously revolute; corolla 4.5–5.5 mm long. 24. *M. schomburgkii.*

7. Leaf-blades, including the midrib and nerves, partially pubescent on one or both sides.

9. Stipules rounded or obtuse at apex.

10. Calyx-lobes minutely ciliolate; stipules appressed-ciliolate; lower leaf surface glabrous or nearly so or with a few scattered, appressed hairs on some of the tertiary veins. 3. *M. pariensis.*

10. Calyx-lobes glabrous or shortly appressed-strigillose on some portion but not ciliolate; stipules glabrous on margins; lower leaf surface sparsely to abundantly strigillose with short appressed hairs. 4. *M. macrophylla.*

9. Stipules mainly acute, acuminate, or subcaudate at apex.

11. Pubescence of midrib and lateral nerves on lower side of leaf-blade of hirsute, spreading or nearly spreading hairs mainly 1–1.5 mm long.

12. Lateral nerves of leaf-blades mainly 6–7 on each side; leaf-blade abruptly acuminate at apex, the tertiary venation of upper surface not rugulose-sulcate. 7. *M. ursina.*

12. Lateral nerves of leaf-blades 7–9 on each side; leaf-blade subacute to obtusely acute at apex, the tertiary venation of upper surface rugulose-sulcate. 8. *M. duckei.*

11. Pubescence, when present, of midrib and lateral nerves on lower side of leaf-blade of mostly appressed or strongly ascending hairs parallel to the midrib or nerve and 1 mm or less long, or, if spreading, then less than 1 mm long.

13. Hairs on lower surface of leaf-blades about 1 mm long, those of midrib and lateral nerves of lower side of leaf-blade about 1 mm long. 8. *M. duckei.*

13. Hairs on lower surface of leaf-blades less than 1 mm long, those of midrib and lateral nerves on lower side of leaf-blade less than 1 mm long.

14. Lateral nerves and midrib of upper leaf surface impressed or raised, not sulcate.
  15. Lateral nerves of leaf-blades 8–10 on each side; leaves broadly elliptic-ovate to oblong-elliptic, abruptly acuminate at apex, 6.5–9.5 cm broad; peduncle of fruiting inflorescence 1–3.2 cm long, the lowest lateral branches only 2–6 mm long. 9. *M. sipapoensis*
  15. Lateral nerves of leaf-blades 4–6 on each side; leaves obovate to oblong-obovate, rounded and acutely obtuse to obtuse at apex, 4–6 cm broad; peduncle of fruiting inflorescence 6.5–8.5 cm long, the longest lateral branches 10–55 mm long. 22. *M. eglerii.*
14. Lateral nerves and midrib of upper leaf surface obscurely to prominently sulcate.
  16. Calyx portion above hypanthium glabrous or with a few short appressed inconspicuous hairs.
    17. Upper leaf surface lacking rugulose-sulcate tertiary venation; leaf margin at most obscurely or slightly subrevolute.
      18. Lateral nerves of leaf-blades 6–7; leaf-blades broadest in lower half. 12. *M. panurensis.*
      18. Lateral nerves of leaf-blades mainly 8–10 on each side; leaf-blades broadest at middle. 13. *M. gabrielensis.*
    17. Upper leaf surface with prominent rugulose-sulcate tertiary venation; leaf margin conspicuously revolute.
      19. Most of lower leaf surface glabrous, not covered by tomentum, only the tertiary venation with sparse to moderate density of spreading to subappressed short hairs; corolla 4 mm long. 17. *M. sarmentosa* f. *sparsipilosa.*
      19. Lower leaf surface densely covered and hidden by a crowded tomentum; corolla 4.8–6 mm long.
        20. Filaments about 1 mm long, about as long as the anthers; corolla 4.8–5 mm long, the lobes longer than the tube; calyx portion with pronounced undulate-repand shallow lobes. 17. *M. sarmentosa.*
        20. Filaments 0.3–0.4 mm long, much shorter than the anthers; corolla 5–6 mm long, the lobes about as long as the tube; calyx portion subtruncate without pronounced lobes or undulate portions. 18. *M. subtruncata.*
  16. Calyx portion above hypanthium more or less appressed-pubescent with moderate to abundant density.
    21. Lower leaf surface densely covered and hidden by a crowded tomentum.
      22. Leaves rounded or obtuse at base and apex; corolla lobes not tipped by setulose hairs. 17. *M. sarmentosa.*
      22. Leaves narrowed to an acute or subacute base and apex; corolla-lobes tipped by setulose hairs. 21. *M. setulosa.*
    21. Lower leaf surface not hidden by a crowded tomentum.
      23. Tertiary venation not elevated nor rugulose on lower leaf surface.
        24. Anthers 1–1.5 mm long; corolla 6 mm long, lobes 3–3.2 mm long; petiole 6–14 mm long; stipules acuminate to caudate; lateral nerves of leaf-blades 8–11 on each side. 13. *M. gabrielensis.*
        24. Anthers 0.8 mm long; corolla 5–5.5 mm long, lobes 2.5–2.8 mm long; petiole 5–7 mm long; stipules acute; lateral nerves of leaf-blades 5–8 on each side. 15. *M. ueiensis.*
      23. Tertiary venation elevated and subrugulose on lower leaf surface.
        25. Lateral nerves of lower leaf surface with hairs parallel or appressed to their length.
          26. Anthers subsessile, the filaments nearly obsolete, 0.1–0.2 mm long. 16. *M. auyantepuiensis.*

26. Anthers with filament manifest, 0.4–2 mm long.
    27. Floral clusters each sessile, the complete inflorescence (measured from base of peduncle to topmost flowers) 3–6 cm long; style 4.5 mm long; filaments 0.4–0.5 mm long, 2–3 times shorter than anther. 10. *M. guaiquinimensis.*
    27. Lowest two tiers of floral clusters on lateral axis 5–20 mm long, the complete inflorescence 8–12 cm long; style 3 mm or less long; filaments 1.8–2 mm long, longer than the anther. 14. *M. ptariensis.*

25. Lateral nerves of lower leaf surface with hairs divaricately spreading or curving away from nerve axis.
  28. Leaf-blades acute to acuminate at apex; tertiary venation prominently and uniformly reticulate rugulose-elevated over the whole lower leaf surface.
    29. Lateral nerves of leaf-blades 8–10 on each side; petiole densely strillose-tomentose throughout; midrib of lower side of leaf densely and abundantly strigose with hairs usually appressed and parallel to midrib; corolla 6.25 mm long; anthers 1.3–1.4 mm long; all tiers of floral clusters sessile or subsessile on the main rachis. 10. *M. guaiquinimensis.*
    29. Lateral nerves of leaf-blades 10–12 on each side; petiole glabrate to strigose mainly along the upper side, or at most only moderately strigose; midrib of lower side of leaf sparsely to somewhat moderately puberulous with hairs mainly spreading to divaricate from midrib; corolla 5.5 mm long; anthers 0.8–0.9 mm long; the lowest 2–3 tiers of floral clusters usually on lateral axes attached to the rachis. 11. *M. cruzii.*
  28. Leaf-blades mainly rounded, obtuse or rarely subacute at apex; tertiary venation inconspicuously reticulate and only weakly rugulose-elevated on lower leaf surface.
    30. Tertiary venation and veinlets of lower leaf surface with more abundant and longer trichomes than in intervening spaces; cilia of calyx-lobes rather abundant and uniformly dispersed along the margin, about 0.4–0.5 mm long. 19. *M. ciliolata.*
    30. Trichomes rather uniformly abundant throughout lower leaf surface; cilia of calyx-lobes, if present, scattered, sparse, and shorter, about 0.2–0.3 mm long. 20. *M. chimantensis.*

1. **Malanea hirsuta** Standl. Field Mus. Bot. Ser. **8**: 61. 1930.

Type. A few miles south of Colonia Tovar, Estado Aragua, Venezuela, at alt. 1050 m, 16 May 1855, *Fendler 569* (holotype G, isotype F, NY).

Distribution. Coastal Cordillera in Distrito Federal, Estado Miranda, and Estado Aragua, north-central Venezuela, at alt. 1300–2200 m, in rich cloud forest. In addition to the type collection, the following specimens belong here: El Junquito, *Lasser 1117;* east of El Junquito, *Steyermark 56997.*

2. **Malanea fendleri** Standl. Field Mus. Bot. Ser. **8**: 61. 1930.

Type. Near Colonia Tovar, Estado Aragua, Venezuela, at alt. 1800 m, *Fendler 25555* (holotype G).

Distribution. Coastal Cordillera in Estado Aragua and Estado Miranda, north-central Venezuela, at alt. 1200–1800 m, in rich forest. In addition to the type collection, the following specimens belong here: Estado Aragua: Parque

Nacional Pittier, *Steyermark 90995;* Estado Miranda: Los Guayabitos, *Aristeguieta 2930;* Parque Nacional Guatopo, *Steyermark 90177.*

3. **Malanea pariensis** Steyermark, sp. nov. Fig. 35.

Scandens, stipulis ovato-oblongis apice rotundatis 6.5–10 mm longis 5–6 mm latis, marginibus albido-ciliatis ad medium sursum laxe pilosis; foliis petiolatis, petiolis 8–10 mm longis dense strigosis; laminis subcoriaceis ovatis vel oblongovel ovato-ellipticis apice abrupte acuminatis vel obtuse acuminatis basi obtusis vel subobtusis 6.5–9 cm longis 3–5.5 cm latis, supra glabris vel interdum per costam mediam paullo strigillosis, subtus plus minusve glabris vel pilis remotis brevibus adpressis instructis, costa media nervis lateralibusque plus minusve strigillosis exceptis; nervis lateralibus utroque latere 6–7; inflorescentiis 2–5 cm longis, rhachide pedunculoque hirtello-strigoso pilis adscendentibus instructis, 5–17 mm longe pedunculatis, ramis inferioribus brevibus axibus infimis 6–10 mm longis ceteris 3–5 mm longis; floribus in 3–5 glomerulos spiciformes pauciflores dispositis; inflorescentiae bracteis basi florum ovatis vel suborbiculari-ovatis acutis extus parce strigosis ciliolatis; calyce hypanthioque subcylindrico 2.5 mm longo 1.5 mm lato, calyce 1 mm alto glabro vel pilis remotis adpressis paucis instructis apice manifeste 4-lobato, lobis suborbiculari-ovatis rotundatis 0.6 mm altis 0.9–1 mm latis ciliolatis; hypanthio extus glabro; corolla campanulata 5.5 mm longa, tubo 2.5 mm longo apice 2.5 mm lato extus dense strigilloso basi glabra excepta lobis 4 oblongis obtusis 3 mm longis 1.7 mm latis extus dense strigillosis intus breviter villosulis; antheris 4 oblongis 0.8 mm longis, filamentis 1.2 mm longis glabris ad faucem insertis; stylo 2.5 mm longo glabro.

Type. Liana; corolla creamy-white to pale yellow; selva nublada por debajo de la cumbre, Cerro Patao, norte de Puerto de Hierro, noreste de Güiria, Peninsula de Paria, Estado Sucre, Venezuela, at alt. 800–825 m, 19 Jul 1962, *Julian A. Steyermark & Getulio Agostini 91126* (holotype VEN).

This species is characterized by its combination of ciliolate calyx-lobes, prominently ciliate stipules, mainly glabrous lower surface of leaf-blades, subcylindric calyx and hypanthium, and campanulate corolla with short tube and with lobes longer than the tube.

4. **Malanea macrophylla** Bartl. in Schomb. Faun. Fl. Brit. Guiana. 947. 1848, hyponym; Griseb. Fl. Brit. W. Ind. 337. 1861.

This is the most widely distributed species of *Malanea,* ranging from the West Indies southeast along the Venezuelan Coastal mountains and Altiplanicie de Nuria into British and Dutch Guiana, and into Brazil along the coastal areas of Pará, Territorio Amapá, Maranhão, and locally around Bahia in the state of Bahia.

Variability is present in the shape, size, apex and base of the leaf-blades, and in the indument of their lower side, varying from sparsely to moderately or even abundantly appressed-strigillose on the lower surface with short colorless hairs 0.1–0.5 mm long in the widespread *M. macrophylla* var. *macrophylla* f. *bahiensis* to densely silvery beneath with a dense short tomentum of close hairs in typical *M. macrophylla* var. *macrophylla* f. *macrophylla.* In var *macrophylla* f. *cuneata* the leaf-base is quite cuneate with the leaf-blades often 2–2-1/2 times as long as broad, and about 1-1/3–2-1/3 times in var. *macrophylla* f. *macrophylla.* In var. *megalantha* the corolla is longer with a longer style than in var. *macrophylla.*

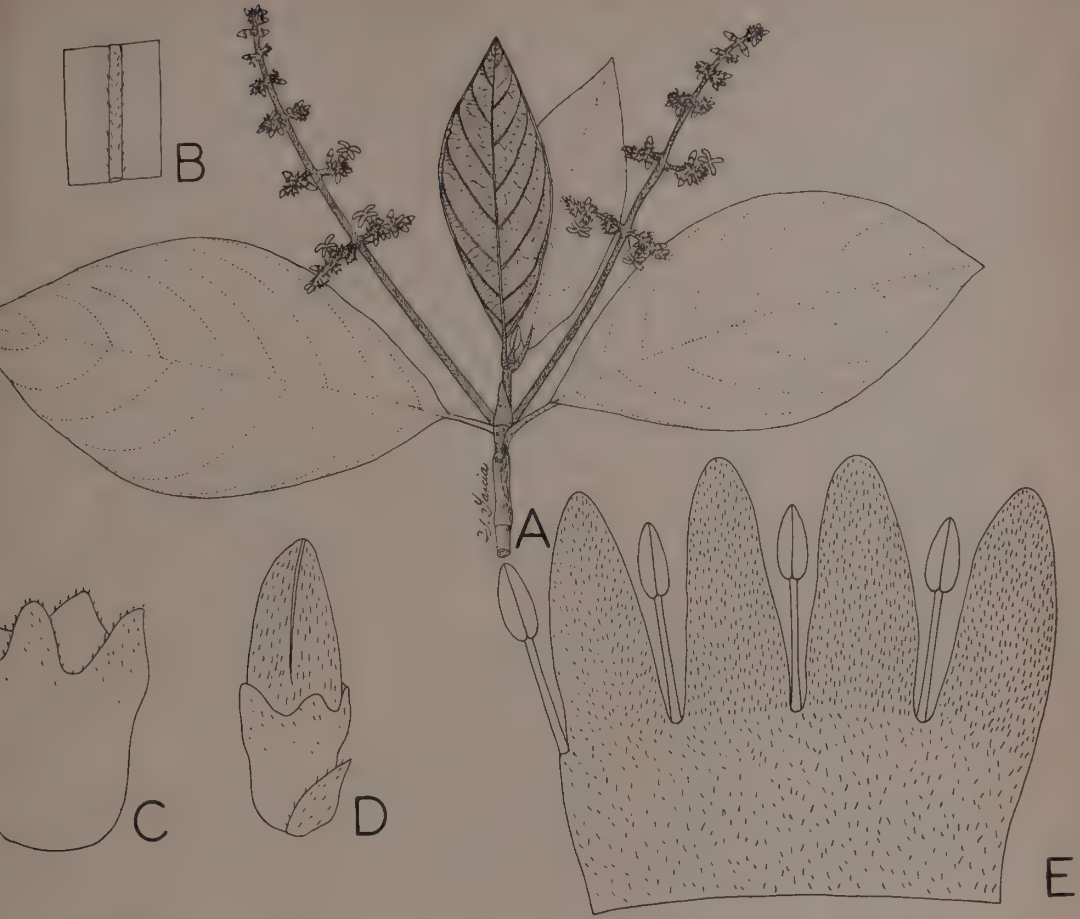

FIG. 35. *Malanea pariensis.* A, flowering branch, habit, × 1/2. B, portion of lower surface of leaf, × 1-1/2. C, calyx with hypanthium, exterior view, × 10. D, corolla in bud, with calyx and subtending bract, × 6. E, corolla, interior view, × 10.

Malanea macrophylla has been variously recorded as tree to 60 feet tall, scandent shrub, shrub, or liana. Whether the taxon itself is actually as variable in habit as indicated by the data on collectors' labels, or has been misjudged by faulty field observation, remains to be discovered.

It is probable that *M. glabra* A. Rich. may eventually apply to this species. If so, it would have to supplement *M. macrophylla,* as the correct name, having been published previously, in 1834. However, at present the applicability of the name is uncertain in the absence of referral to a type specimen.

Key to the Varieties and Forms of *Malanea macrophylla*

1. Lower surface of leaf-blades with a dense crowded tomentum, the hairs hiding or nearly hiding the leaf surface, the surface often silvery-gray or silvery-green. var. *macrophylla* f. *macrophylla.*

1. Lower surface of leaf-blades with a sparse to abundant strigillose pubescence of appressed hairs 0.1–0.5 mm long, these not close enough to hide the leaf surface, the surface usually pale green.

2. Leaf-blade mainly acute to subacuminate at base, 2–2-1/2 times as long as broad. var. *macrophylla* f. *cuneata.*
2. Leaf-blade mainly obtuse to rounded at base, mainly 1-1/3–2 times as long as broad.
    3. Commonly encountered variation; corolla 4–5 mm long, the tube shorter than to slightly longer than the lobes; style 3–3.5 mm long. var. *macrophylla* f. *bahiensis.*
    3. Rare variation, known only from Tobago Island; corolla 6–7 mm long, the tube more than 1-1/2 times longer than the lobes; style 5 mm long. var. *megalantha.*

4a. Malanea macrophylla Bartl. ex Griseb. var. **macrophylla** f. **macrophylla.**

Type. Banks of the Morocco River, British Guiana, *Rich. Schomburgk.*

Distribution. Upland forest, Estado Bolívar in Altiplanicie de Nuria of Venezuela, British Guiana, and Territorio Amapá and Estado Amazonas, Brazil.

The typical variation of *M. macrophylla* comes from northwestern British Guiana between the Barama and Pomeroon rivers near the coastal area at a low elevation (banks of the Morocco river). Since collections in British Guiana from this general region (Pomeroon and Aruka rivers) have the leaves with the lower surface covered by a dense close tomentum nearly hiding the surface, this type of variation is here considered to apply to the type collection. The less pubescent variation, with spare to abundant strigillose appressed hairs not hiding the tomentum, applies to the more widespread var. *macrophylla* f. *bahiensis.*

4a′. Malanea macrophylla var. **macrophylla** f. **bahiensis** (M. Arg.) Steyermark, comb. nov.

M. bahiensis M. Arg., Flora **58**: 453. 1875, type: In Brasilia intratropica circa Bahia, 1831, *J. Blanchet 586* (holotype P, isotype NY).

Distribution. West Indies (Grenada, St. Vincent, Trinidad), Coastal Cordillera of north-central Venezuela (Estado Miranda), British and Dutch Guiana, and Brazil (Territorio Amapá, Estado Maranhão, Estado Bahia). This is the most widespread of the variations of *M. macrophylla.*

4a″. Malanea macrophylla var. **macrophylla** f. **cuneata** Steyermark, f. nov.

A f. *macrophylla* differt foliorum laminorum laminis basi cuneatis apice acuminatis subtus sparse vel moderate adpresso-pilosulis pilis brevibus instructis, costa media nervis lateralibusque subtus sparse strigillosis pilis fere 0.5 mm longis instructis.

Type. Dense forest; basin of Kuyuwini river (Essequibo tributary), about 150 miles from mouth, British Guiana, 21–26 Nov 1937, *A. C. Smith 2618* (holotype NY). Paratypes. BRAZIL. Northeast woods of the Instituto Agronomico do Norte, Belém, Pará, 30 Oct 1942, *W. A. Archer 7759* (NY, US). SURINAME. Savanna forest, km 9.2, *Lanjouw & Lindeman 698;* Brownsberg, *Herb. no. 6637; Berthoud-Coulon 165.*

4b. Malanea macrophylla var. **megalantha** (Wernh.) Steyermark, stat. nov.

M. megalantha Wernh. Jour. Bot. **51**: 221. 1913, type: Easterfield, Tobago, 21 Oct 1910, *W. E. Broadway 4024* (holotype BM, isotype NY).

Distribution. Known only from the island of Tobago. In addition to the type collection in flower, a fruiting specimen (*Broadway 4651*), also from Tobago, belongs here.

5. **Malanea hypoleuca** Steyermark, sp. nov.

Scandens, stipulis oblongis apice rotundatis 8–12 mm longis 4–5.5 mm latis extus basi medioque dense strigillosis prope margines glabris; foliis petiolatis, petiolis 11–20 mm longis glabris vel sparse cinereo-strigosis; laminis late ovatis vel oblongo-ovatis apice abrupte acutis vel subacuminatis basi obtusis vel rotundatis 7–12.5 cm longis 4–9 cm latis supra glabris, subtus cinereo-glaucis pubescentibus pilis minutis densis velutinis praeditis, costa media nervis lateralibusque subtus moderate pilis adpressis strigosis; nervis lateralibusque utroque latere 6–8; inflorescentiis 3.5–5.5 cm longis, rhachide dense cinereo-strigillosa, 15–20 mm longe pedunculatis, ramis infimis 5–10 mm longis; floribus in tribus ordinibus conspersis; inflorescentiae bracteis basi ramorum ovatis vel lanceolatis acuminatis 2–2.5 mm longis extus dense strigillosis; florum bracteis late ovatis extus dense cinereo-strigillosis; calyce hypanthioque profunde cylindrico-campanulato 1.5–2 mm longo apice 1.5 mm lato, calyce 0.8–1 mm alto, extus moderate strigilloso apice 4-repando-undulato, lobis late rotundatis; hypanthio glabro vel basi sparse strigoso; corolla campanulato-subinfundibuliformi 4.5 mm longa, tubo 2.2 mm longo 0.8 mm lato apicem versus 2 mm lato extus dense strigoso intus villosulo, lobis 4 ovato-oblongis obtusis 2.2 mm longis 1.5 mm latis extus dense strigillosis; antheris 4 oblongis 1 mm longis, filamentis 0.5–0.6 mm longis glabris ad faucem insertis; stylo 2 mm longo glabro basi minute sparseque strigilloso excepto; fructu juvenili anguste oblongo 9–11 mm longo 3–4 mm lato.

Type. Climbing; leaves subcoriaceous, silvery below with raised nerves, deep green above with sulcate nerves; rachis gray-green; hypanthium pale green; fruit purple, shining; forested slopes, vicinity of km 110, south of El Dorado, Estado Bolívar, Venezuela, at alt. 800–1200 m, 6–11 Mar 1962, *Julian A. Steyermark & Leandro Aristeguieta 5* (holotype VEN). Paratypes. VENEZUELA. Estado Bolívar: Cerro Venamo, vecindades del salto, Río Venamo, at alt. 900 m, *Steyermark, G. C. K. & E. Dunsterville 92899*. BRITISH GUIANA. Matthews Ridge, Barima River, northwest territory, *Maguire & Cowan 39347;* Pakaraima Mountains: Membaru-Kurupung trail, *Maguire & Fanshawe 32439.*

This species differs from *M. macrophylla* in the pubescent base of the style and strigillose calyx with shallow repand-undulate lobes.

6. **Malanea tafelbergensis** Steyermark, sp. nov.

Frutex scandens vel volubilis; stipulis late oblongis vel obovato-oblongis apice rotundatis vel late obtusis 6–9 mm longis 3–4.5 mm latis extus breviter strigillosis marginibus apiceque glabris exceptis; foliis petiolatis, petiolis 3–8 mm longis dense breviter strigillosis; laminis elliptico-ovatis vel ovatis apice abrupte hebiterque acutis vel subobtusis basi cuneatim angustatis acutis vel subacutis 2.2–6.5 cm longis 1.2–4 cm latis, supra glabris vel glabratis subtus moderate strigillosis pilis brevibus adpressis 0.2–0.4 mm longis instructis; nervis lateralibus utroque latere 5–6; inflorescentiis 8–29 mm longis brevipedunculatis, pedunculo 3.6 mm longo, rhachidi tenui dense strigosa 1 mm diam; floribus sessilibus paniculis paucifloris; bracteis flores subtendentibus ovatis vel suborbicularibus acutis vel subacutis extus breviter atque minute strigillosis ciliolatis; calyce hypanthioque profunde campanulato 1.8–2 mm longo apice 1.5–1.8 mm lato; hypanthio extus glabro; calyce 0.8–0.9 mm longo intus glabro late 4-lobato, lobis suborbicularibus late rotundatis 0.3–0.4 mm longis 0.8 mm latis extus breviter moderateque minute strigillosis pilis ca. 0.05–0.1 mm longis praeditis ciliolatis; corolla infundibuliformi 3.5–4 mm longa basi 0.8–0.9 mm lata fauce 2 mm lata, tubo 2–2.2 mm longo extus dense breviter strigilloso basi ipsa glabra excepta, intus dense villosulo, lobis 4 ovato-oblongis obtusis 1.5–2 mm longis 0.8–1 mm latis extus dense breviter strigillosis intus dense villosulis; antheris 4 oblongis apice rotundatis 0.8–0.9 mm longis sessilibus vel subsessilibus ad faucem corollae insertis, filamentis nullis vel obsoletis; stylo 2.7 mm glabro, stigmatibus rhomboideo-suborbicularibus rotundatis 0.5 mm longis.

Type. Scandent shrub or vine; flowers white; frequent, Savanna No. 8, Tafelberg, Suriname, at alt. 776 m, 28 Aug 1944, *Bassett Maguire 24530* (holotype NY). Paratype. Vicinity of Savanna No. 9, Tafelberg, 6 Sep 1944, *Maguire 24648* (NY).

7. **Malanea ursina** Standl. Field Mus. Bot. Ser. **8**: 62. 1930.

Type. Río Vasiva, Venezuela, *R. Spruce* (holotype K, photo at F).

Distribution. Known with certainty only from the type collection.

A fragment of the leaf of the type specimen is in the herbarium at F. It shows the leaf-blade with a lower surface moderately pubescent with short appressed hairs 0.3–0.5 mm long and occasional longer hairs and with the midrib and lateral nerves of the lower surface with hirsute spreading hairs 1–1.5 mm long. The upper surface is glabrous with prominently sulcate midrib and 6 lateral nerves on each side deeply sulcate. The photo of the holotype shows an inflorescence about 5 cm long and a peduncle 1.3 cm long; the glomerules of flowers are nearly all sessile, but the lowest two are on very short axes 1–2 mm long.

8. **Malanea duckei** Standl. Field Mus. Bot. Ser. **22**: 117. 1940.

Type. Silva non inundabili leviter paludosa, Manaos, circa Cachoeira do Mindu, Amazanos, Brazil, 12–7–1937, *A. Ducke 34799* (holotype F). Paratype. Circa Cachoeira do Mindú, Manaos, 12–5–1937, *Ducke 494* (US).

Distribution. Known only from the Amazon basin, Amazonas, Brazil.

9. **Malanea sipapoensis** Steyermark, sp. nov.

Planta ligneosa volubilis, stipulis ovatis acuminatis vel subcaudatis 8–13 mm longis 6–6.5 mm latis infra medium basique dense strigillosis aliter glabris, marginibus ciliatis; foliis petiolatis, petiolis 15–40 mm longis sparse breviterque strigillosis vel glabratis; laminis late elliptico-ovatis vel oblongo-ellipticis apice abrupte acuminatis basi acutis vel subacutis 12.5–16 cm longis 6.5–9.5 cm latis, supra glabris vel pilis paucis remotis hirsutulis conspersis costa media nervis lateralibus breviter strigillosis impressis, subtus moderate adpresso-pilosulis costa media nervis lateralibusque breviter adpresso-strigillosis, marginibus ciliatis planis non revolutis; nervis lateralibus utroque latere 8–10; inflorescentiis 5–9.5 cm longis 1–3.2 mm longe pedunculatis, rhachidi dense cinereo-strigillosa, ramis paucifloris infimis 2–6 mm longis ceteris sessilibus; bracteis flores subtendentibus ovatis extus hirsutulis ciliatis; calyce hypanthioque profunde campanulato, calyce 0.8 mm longo, lobis late suborbiculari-ovatis apice late rotundatis 0.3 mm longis extus prope apicem sparse vel moderate strigillosis ciliolatis; corollis non visis; fructibus 10–11 mm longis 4 mm latis.

Type. In montane woodland near Intermediate Camp, Cerro Sipapo (Paráque), Amazonas, Venezuela, at alt. 600 m, 2 Feb 1949, *Bassett Maguire & Louis Politi 28743* (holotype NY).

This species is distinguished by the ciliate leaf-margins and the ciliate stipules. It simulates *M. macrophylla,* but has acuminate to subcaudate stipules. It also resembles *M. gabrielensis,* but the leaf-blades are longer and broader, longer-petiolate, and the lateral leaf nerves above are impressed, not sulcate.

10. **Malanea guaiquinimensis** Steyermark, sp. nov.

''Arbor 6-metralis'' (fide Cardona), stipulis ovatis acuminatis 7–10 mm longis basi medioque hirsutulis vel longistrigosis apice marginibusque glabris, marginibus glabris vel ciliato-hispidis; foliis petiolatis, petiolis 10–21 mm longis dense adpresso-hirsutulis; laminis oblongo-ellipticis apice acutis vel subacutis basi subacutis vel obtusis 9–12 cm longis 3–6 cm latis, supra rugulosis sulcato-nervatis glabris costa media strigosa excepta atque nervis lateralibus interdum strigosis, subtus costa media nervis lateralibusque valde elevatis moderate strigillosis pilis 0.4–0.5 mm longis instructis superficie valde ruguloso-reticulata moderate adpresso-pilosula pilis brevibus pallidis 0.3–0.4 mm longis praedita; nervis lateralibus utroque latere 8–10; inflorescentiis 3–6 cm longis 2–3.5 cm longepedunculatis, rhachidi dense castaneo-hirtella pilis adscendentibus vel adpressis, floribus in 3–5 glomerulis simplicibus sessilibus instructis; calyce hypanthioque profunde campanulato 2.5 mm longo 1.8 mm lato, hypanthio 1.5 mm longo extus glabro; calyce 1.5 mm longo intus glabris extus moderate vel dense strigilloso pilis usque ad 0.5 mm longis, lobis 4 late triangulari-suborbicularibus apice rotundatis 0.5 mm longis 1 mm latis; corolla campanulato-infundibuliformi 6.25 mm longa extus dense strigosa intus villosula, tubo 3 mm longo basi 1 mm lato fauce 2–2.5 mm lato extus valde strigoso intus villoso, lobis 4 lanceolato-oblongis obtusis 2.7–2.8 mm longis 1.3–1.4 mm latis extus valde strigosis intus villosulis; antheris 4 anguste oblongis 1.3–1.4 mm longis, filamentis antheris brevioribus ca. 0.4–0.5 mm longis; stylo 4.5 mm longo glabro, stigmatibus late rhomboideo-oblongis 0.5 mm longis; fructu ovato-oblongo 11–12 mm longo 5–6 mm lato.

Type. Tree 6 m high, Cerro Guaiquinima, Alto Río Paragua, Estado Bolívar, Venezuela, at alt. 1200 m, 10 Jul 1944, *Felix Cardona 1117* (holotype US, isotypes F, VEN).

This species differs from *M. duckei* Standl. in having the filaments shorter than the anthers, densely strigose calyx and outer surface of the corolla, longer style, and more prominent calyx-lobes.

11. **Malanea cruzii** Steyermark, sp. nov.

Planta ligneosa 1-metralis (fide De La Cruz), ramis juvenilibus dense ferrugineo-strigosis; stipulis ovato-lanceolatis acuminatis vel subcaudatis 7–8 mm longis extus glabris medio strigoso, marginibus sparse vel manifeste adpresso-ciliatis; foliis petiolatis, petiolis 8–11 mm longis glabratis vel marginibus supra strigillosis; laminis oblongo-ellipticis vel elliptico-oblanceolatis, apice abrupte acutis vel subacuminatis basi acutis vel obtusis ad rotundatis 8–15 cm longis 3–6 cm latis, marginibus paullo revolutis, supra nervis lateralibus sulcatis venulis tertiariis paullo sulcato-rugulosis, subtus nervis lateralibus tertiariisque elevatis paullo rugulosis, supra glabris costa media interdum partim strigillosis, subtus superficie glabra vel abundante hirtello-strigillosa pilis 0.5 mm longis instructa, costa media nervis lateralibusque subtus hirsutulis pilis paucis vel numerosis patentibus vel curvatis 0.5–0.7 mm latis instructis; nervis lateralibus utroque latere 10–12; inflorescentiis 5–10.5 cm longis 1.5–4 cm longe pedunculatis, dense fulvostrigosis, ramis 1–3 inferioribus cum axibus elongatis infimis ad 12 mm longis, ceteris brevioribus, supremis sessilibus; bracteis flores subtendentibus ovatis acutis 1.2–1.5 mm longis ciliatis extus hirsutulis; calyce hypanthioque 2

mm longo, hypanthio profunde campanulato glabro; calyce 1 mm longo 4-lobato, lobis late deltoideo-suborbicularibus rotundatis 0.3–0.5 mm longis ca. 1 mm latis prope apicem breviter strigillosis vel subsetulosis pilis 0.2–0.3 mm longis instructis inter lobos glabris apice pauciciliatis; corolla subcylindrica 5.5 mm longa, tubo 2.5 mm longo extus sparse vel moderate strigilloso intus dense villosulo, lobis 4 lanceolato-oblongis obtusis 3 mm longis 1.25 mm latis extus sparse breviter strigillosis intus dense villosulis; antheris anguste oblongis obtusis 0.8–0.9 mm longis, filamentis 0.4–0.7 mm longis glabris.

Type. 3 feet high (fide De La Cruz); Upper Mazaruni River, Long. about 60° 10′ W, British Guiana, 22 Sep–6 Oct 1922, *J. S. De La Cruz 2164* (holotype NY).

This species is most closely related to *M. guaiquinimensis* Steyerm., from which it differs in having the lowest 1–3 tiers of flowers on lateral axes, less densely pubescent calyx and external surface of the corolla, shorter corollas and anthers, less pubescent petioles, and more numerous lateral nerves of the leaf-blades.

12. **Malanea panurensis** M. Arg. in Flora **58**: 453. 1875.

Type. Prope Panure ad Rio Uaupes, Brazil, Oct 1852–Jan 1853, *R. Spruce 2526* (holotype K, isotype NY).

Distribution. Upper Rio Negro-Uaupes drainage, Amazonas, Brazil. In addition to the type collection, *Froes 21168* from Jauareté, Rio Negro, Vaupés, may be cited here.

The photo of the holotype at K deposited at NY shows the broad ovate leaf-blades with subacuminate apex and rounded base and few lateral nerves as described for this species. However, the photo from B at F has two discordant elements shown mounted on the same photo: the upper fragmentary branch is the broad-leaved, few-nerved *M. panurensis* with acute apex and rounded leaf-base; the lower fragmentary branch has oblong leaf-blades which are rounded to obtuse at the apex and subacute at the base, and with 9 lateral nerves on each side which are definitely sulcate on the upper surface. On the upper specimen of the B photo the true *M. panurensis* specimen has an evident flowering rachis with all the glomerules of flowers sessile, the inflorescence as a whole 2.7 cm long. The lower specimen on this photo does not belong with *M. panurensis*, and represents a different species.

13. **Malanea gabrielensis** M. Arg., Flora **58**: 453. 1875.

Type. Stout climber; flowers pale yellow; falls of San Gabriel, gapo, Amazonas, Brazil, Aug 1852, *R. Spruce 2410* (holotype K, photo NY).

Distribution. In the drainage of the upper Orinoco, Río Negro, and Río Guainía, southwestern Venezuela and northwestern Brazil. BRAZIL. Falls of San Gabriel, *Spruce 2410* (holotype); below Salto de Huá, Rio Maturacá, Amazonas, *Holt & Blake 530*. VENEZUELA. Río Yatua, Cerro de la Neblina, just south of Camp 3 at alt. 650 m, *Maguire, Wurdack & Bunting 36976;* en la margen arboreada de las rebalsas y del Río Sanariapo, Sanariapo, Amazonas, at alt. 120 m, 3–7–1942, *Williams 16009;* Laja Catipan, Río Yatua, Casiquiare, Amazonas, at 110–150 m alt, *Maguire, Wurdack & Maguire 41593;* ad flumen Pacimoni, Amazonas, *Spruce 3447;* morichal at east base of Piedra Marimare, 2 km east of Río Orinoco, east bank opposite head of Isla El Gallo, Estado Bolívar, at alt. 100 m, *Wurdack & Monachino 40880.*

Collectors have recorded this species as both liana and shrub. The collection of *Holt & Blake 530* has the leaf-blades with 11 lateral pairs of nerves.

14. **Malanea ptariensis** Steyermark, sp. nov.

Planta ligneosa volubilis, stipulis ovato-lanceolatis acutis vel acuminatis 9–16 mm longis extus basi medioque usque ad infra apicem albido-strigillosis, marginibus glabris vel plerumque ciliolatis; foliis petiolatis, petiolis 9–15 mm longis dense strigillosis; laminis elliptico-ovatis vel oblongo-ovatis apice abrupte hebiterque acutis vel acuminatis basi subacutis vel obtusis raro rotundatis 8–14 cm longis 4–7 cm latis, marginibus revolutis, supra glabris glabratis vel sparse strigillosis ubi sulcatis tenuiter ruguloso-nervatis paullo tenuiter sulcatis, subtus nervis lateralibus elevatis strigillosis pilis brevibus adpressis instructis superficie ipsa sparse vel moderate adpresso-pubescenti striolata pilis brevibus albidis instructis; nervis lateralibus utroque latere 6–8; inflorescentiis 8–12 cm longis 3–6 cm longe pedunculatis, pedunculo rhachidi dense fulvo-hirtello-strigillosis pilis brevibus adpressis instructis, glomerulis 4–6 duobus infimis cum axibus 5–20 mm longis; pedunculi bracteis infimis lineari-subulatis 7–8 mm longis glabratis ciliolatis; florum bracteis late triangulari-ovatis vel late lanceolatis acutis 1.5–2 mm longis medio extus strigosis marginibus setosis; calyce hypanthioque profunde campanulato 3 mm longo apice 2 mm lato, hypanthio 1.5 mm longo glabro; calyce 1.5 mm longo manifeste 4-lobato, lobis inaequalibus late triangulari-ovatis rotundatis 0.8–1.1 mm longis 0.7 mm latis extus sparse minute adpresso-strigillosis intus glabris marginibus ciliolatis; corolla cylindrico-infundibuliformi 6 mm longa, tubo 2–2.5 mm longo basi 1.5 mm lato fauce 2.5 mm lato extus breviter dense cinereo-strigilloso intus villosulo, lobis 4 lanceolato-oblongis obtusis 3.5 mm longis 1.5 mm latis extus dense cinereo-strigosis intus villosulis; antheris anguste oblongis 1 mm longis, filamentis 1.8–2 mm longis glabris; stylo (immaturo) 2.3 mm longo glabro; fructu ovoideo 10 mm longo 6 mm lato.

Type. Ligneous vine; leaves subcoriaceous, subrevolute, nerves prominent below; calyx and rachis pale green; fruit ovoid, pointed at tip, dark purplish-black, shining; densely forested, steep, south-facing slopes overlying sandstone, between "Cave Rock" and base of high sandstone bluffs, Ptari-tepui, Estado Bolívar, Venezuela, at alt. 2285–2405 m, 30 Oct 1944, *Julian A. Steyermark 59548* (holotype F, isotypes NY, US, VEN).

The relatively well-developed calyx-lobes are characteristic of this species and serve to distinguish it from *M. gabrielensis*.

15. **Malanea ueiensis** Steyermark, sp. nov.

Frutex (fide Steyermark & Nilsson) vel arbor (fide Steyermark & Nilsson), stipulis late lanceolatis acutis 5.5–16 mm longis medio usque ad apicem dense cinereo-strigillosis, marginibus paullo adpresso-ciliolatis; foliis petiolatis, petiolis 5–7 mm longis cano-adpresso-pubescentibus; laminis oblongo-ellipticis vel ovatis apice subacuminatis basi rotundatis acutis vel acuminatis vel juvenilibus acutis vel subacutis 7–13 cm longis 2.5–8 cm latis, marginibus subrevolutis adpresso-ciliolatis, supra nervis sulcatis vel non omnino, nonnihil rugosis atque reticulatis paullo strigilossis ubi sulcatis, subtus costa media nervis lateralibusque strigillosis superficie moderate adpresso-pubescenti; nervis lateralibus utroque latere 5–8; inflorescentiis 7–9 cm longis 2.5–4 cm longe pedunculatis, rhachidi dense strigosa, glomerulis 4–5 infimis cum axibus 5–6 mm longis ceteris sessilibus; ramorum infimorum bracteis lineari-lanceolatis 4 mm longis; calyce hypanthioque 2 mm longo 1.8 mm lato, hypanthio glabro profunde campanulato; calyce 1 mm longo, 4-repando-undulato, lobis late suborbiculari-triangularibus obtusis 0.2–0.7 mm longis 0.6 mm latis extus strigosis intus glabris; corolla 5–5.5 mm longa, tubo subcylindrico-infundibuliformi 2.8–2.9 mm longo basi 0.8–0.9 mm lato fauce 2 mm lato extus moderate strigoso intus villosulo, lobis 4 ovato-oblongis obtusis 2.5–2.8 mm longis 1.3–1.5 mm latis extus strigillosis intus villosulis; antheris anguste oblongis obtusis 0.8 mm longis, filamentis 1 mm longis glabris; stylo 2 mm longo glabro, stigmatibus rhomboideo-oblongis 0.5 mm longis; fructibus elliptico-anguste oblongis 10 mm longis 0.4–0.5 mm latis.

Type. Shrub; leaves subcoriaceous, dull green below; corolla pale yellow; rachis gray green; vicinity of Cerro Uei, vicinity of road campamento 125, between Luepa and Cerro Venamo, Estado Bolívar, Venezuela, at alt. 1100 m, 20–22 Apr 1960, *Julian A. Steyermark & Sven Nilsson 385* (holotype VEN). Paratypes. VENEZUELA. Same locality, *Steyermark & Nilsson 465;* Sororopántepui, *Steyermark 60096*. BRITISH GUIANA. Upper Mazaruni River, Long. about 60° 10′ W, *De La Cruz 2386*. A specimen from Cerro Marahuaca, Amazonas, Venezuela, *Maguire & Maguire 29181* may also belong here.

16. **Malanea auyantepuiensis** Steyermark, sp. nov.

Frutex 1.5 m, stipulis ovatis vel late lanceolatis acutis 11–12 mm longis basi 3 mm latis extus basi medioque dense strigillosis apice marginibusque glabrescentibus, marginibus ciliolatis; foliis petiolatis, petiolis 10–15 mm longis dense strigillosis; laminis elliptico-oblongis vel late ellipticis apice subacutis vel acutis basi acutis vel subacutis 7–11.5 cm longis 3–5.5 cm latis, supra paullo rugulosis sulcato-nervatis glabris, costa media parce strigillosa excepta, subtus costa media nervis lateralibusque manifeste elevatis moderate strigillosis pilis 0.2–0.4 mm longis adpressis instructis, superficie in sicco moderate ruguloso-reticulata moderate adpresso-pilosula pilis brevibus pallidis 0.2–0.4 mm longis praeditis, nervis lateralibus utroque latere 5–10; inflorescentiis 3.5–7.5 cm longis 1.2–3.5 cm longepedunculatis, rhachidi dense cano-fulvo-strigilloso-hirtella, pilis adpressis vel adscendentibus; floribus in 5–6 glomerulis simplicibus sessilibus instructis; calyce hypanthioque campanulato 2.5 mm longo, hypanthio 1 mm longo extus glabro; calyce 1.5 mm longo intus glabro extus moderate vel dense strigilloso, pilis 0.1–0.4 mm longis, lobis 4 late triangulari-suborbicularibus apice rotundatis 0.5 mm longis 1 mm latis, marginibus vel apicibus ciliolatis; corolla campanulato-infundibuliformi 3.5–4 mm longa extus dense strigillosa intus villosula, tubo 1.5–2 mm longo, lobis 4 late oblongis obtusis 2 mm longis 0.7 mm latis; antheris 4 anguste oblongis 0.75–1 mm longis subsessilibus, filamentis subobsoletis 0.1–0.2 mm longis antheris brevioribus; stylo 1.75–2 mm longo glabro; fructu 10–11 mm longo 5–6 mm lato.

Type. Shrub 1.5 m with sprangling elongated branches; leaves subcoriaceous, dull green above, dull green below with raised nerves; along small forested stream amidst rocky brushy slopes, faldas meridionales, Auyan-tepui, entre ''Danto'' y ''El Peñon,'' en la segunda meseta (hombrillo) arriba del valle de Kamarata, Estado Bolívar, Venezuela, at alt. 1530–1800 m, 18 Mayo 1964, *Julian A. Steyermark 94103* (holotype VEN, isotypes NY, US). Paratype. Cumbre de la parte sureste del brazo noroeste (division occidental del cerro), faldas sobre piedras igneas, vecindad del ''Río Lomita Camp,'' Auyán-tepuí, Estado Bolívar, Venezuela, at alt. 1800 m, 10 Mayo 1964, *Steyermark 93579*.

This species is related to *M. ptariensis* Steyerm. and *M. guaiquinimensis*

Steyerm., from which it differs in the subsessile anthers with nearly obsolete filaments and shorter corollas. The floral clusters are all sessile as in *M. guaiquinimensis,* but the style is much shorter. The pubescence of the rachis of the inflorescence is gray to buff, rather than castaneous-ferruginous as in *M. guaiquinimensis.*

17. **Malanea sarmentosa** Aubl. Pl. Guian. **1**: 106. *pl. 41.* 1775.

Cunninghamia sarmentosa (Aubl.) Willd. Sp. Pl. **1**: 651. 1798.

Type. Supra arbores ad ripam amnis galibiensis, French Guiana, *Aublet* (photo of holotype from BM at NY).

I have interpreted this species in a restricted sense. The photo of the type shows leaves revolute, conspicuously rugose both sides with prominently sulcate nerves above, oblong-obovate to oblong leaf-blades obtuse at the apex, and an inflorescence 8–10 cm long, the lowest of the 4–5 flower-clusters on short axes 8 mm long. A specimen from British Guiana, *Sandwith 1163,* matches the photo of the type.

A large number of specimens have been identified as this species, but an examination of all this material has resulted in the segregation of a number of taxa, obviously related to *M. sarmentosa,* but differing from it in sufficient characters of specific value to justify a separation. Within *M. sarmentosa* is found a range of variation, expressed in the following key to varieties and forms.

Key to the Forms of *Malanea sarmentosa*

1. Calyx portion above hypanthium glabrous or with a few short appressed inconspicuous hairs.
    2. Lower leaf surface densely covered and hidden by a crowded tomentum; corolla 4.8–6 mm long. f. *sarmentosa.*
    2. Most of lower leaf surface glabrous, not covered by tomentum, only the tertiary venation with sparse to moderate density of spreading to subappressed short hairs; corolla 4 mm long. f. *sparsipilosa.*
1. Calyx portion above hypanthium more or less appressed-pubescent with moderate to abundant density. f. *tomentosa.*

17a. **Malanea sarmentosa** Aubl. f. **sarmentosa.**

Type. Supra arbores ad ripam amnis galibiensis, French Guiana, *Aublet* (BM, photo NY).

Distribution. French and British Guiana, Surinam, and Trinidad.

17b. **Malanea sarmentosa** Aubl. f. **sparsipilosa** Steyermark, f. nov.

A f. *sarmentosa* differt nervis tertiariis tantum laminarum foliorum subtus pubescentibus pilis brevibus patentibus vel subadpressis sparse vel moderate conspersis, costa media nervis lateralibusque subtus subhirtellis, superficei multo magis subtus cum papillis elevatis praedita pilis nullis; corollis 4 mm longis.

Type. Subscandent shrub 1–2 m high; watershed between Rupununi and Kuyuwini rivers, Parabaru Savanna, lat. about 2° 10′ N, British Guiana, 15–17 Feb 1938, *A. C. Smith 3066* (holotype NY). Paratype. Upper Mazaruni River, Long. about 60° 10′ W, British Guiana, 22 Sep–6 Oct 1922, *J. S. De La Cruz 2201* (NY).

17c. Malanea sarmentosa Aubl. f. **tomentosa** Steyermark, f. nov.

A f. *sarmentosa* differt calyce plus minusve moderate vel abundante adpresso-pubescenti; foliorum laminis subtus dense villosulis per omnes partes; fructibus ovoideis 6–7 mm longis 4 mm latis.

Type. Vine; leaves strongly rugose, pubescence tawny-red; mixed high wallaba forest km 7, line between camps 3 and 2, Saramacca River headwaters, Suriname, 30 Sep 1944, *Bassett Maguire 24874* (holotype NY). Paratype. VENEZUELA. Edge of mesa at border of woods, vicinity of Salto de Pacairo bordering Río Pacairao, about 3 km east to northeast of Santa Teresita de Kavanayen, Estado Bolívar, at alt. 1220 m, 24 Nov 1944, *Steyermark 60525* (F, US).

The leaves vary from broadly obovate to oval to suborbicular-ovate, and are usually quite rounded at the apex or rarely subacute to acute, and broadly rounded to obtuse at the base, with 9–11 lateral nerves on each side. The petioles are 5–8 mm long and densely hirsute-setulose with appressed hairs.

18. Malanea subtruncata Steyermark, sp. nov.

Frutex scandens, stipulis lanceolatis acutis 8 mm longis basi medioque dense hirtello-strigosis prope margines glabris, marginibus subciliatis; foliis petiolatis, petiolis 5–12 mm longis dense hirtellis pilis brevibus subferrugineis conspersis instructis; laminis oblongo-ellipticis vel obovato-oblongis apice abrupte subacutis vel rotundatis basi rotundatis vel subobtusis 7.5–11 cm longis 3.5–6 cm latis, supra valde rugoso-nervatis, subtus rugoso-reticulatis, supra nervis lateralibus costa mediaque breviter sulcatis subtus elevatis, supra superficie plerumque glabra at sparse pubescenti pilis brevibus adpressis remotis instructis atque costa media strigosa ubi sulcata, subtus superficie dense crebreque tomentella nervis lateralibus costa mediaque dense hirsutulis; nervis lateralibus utroque latere 12–13; inflorescentiis 6.5–8 cm longis 20–22 mm longe pedunculatis, rhachidi ferrugineo-tomentello-hirtella, glomerulis 6–7 sessilibus infimis cum axibus 6–15 mm longis; florum bracteis extus hirsutulis ciliatis; calyce hypanthioque profunde campanulato 1.3–1.5 mm longo apice 1.5 mm lato extus glabro; hypanthio 0.5 mm longo; calyce 0.7 mm longo subtruncato apice obsolete repando-undulato utrinque glabro; corolla breviter infundibuliformi 5–6 mm longa, tubo 2.5 mm longo basi 0.7–0.8 mm lato fauce 1.3 mm lato extus breviter strigilloso basi glabra excepta intus dense villosulo pilis elongatis instructis, lobis 4 ovato-oblongis obtusis 2.5 mm longis 1.5 mm latis extus breviter strigillosis intus villosulis; antheris anguste 0.9–1.1 mm longis, filamentis antheris brevioribus 0.3–0.4 mm longis ut videtur glabris; stylo 1.8 mm longo glabro, stigmatibus late oblongis rotundatis 0.7 mm longis papillatis.

Type. Cipó; flor branca-centa; silva non inundabili, Belem Bosque Municipal, Pará, Brazil, 29–IV–1946, *A. Ducke 1943* (holotype NY, isotype US).

This taxon differs from typical *M. sarmentosa* in the wholly glabrous calyx and hypanthium, the subtruncate apex, shorter filaments, and longer corolla-tube.

19. Malanea ciliolata Steyermark, sp. nov.

Planta ligneosa volubilis, stipulis ovato-lanceolatis acuminatis 10 mm longis extus basi medioque strigosis, marginibus ciliolato-strigillosis; foliis petiolatis, petolis 7–15 mm longis dense strigillosis; laminis plerumque oblongis vel ovato-oblongis ad late suborbiculari-ovatis apice rotundatis raro subacutis basi rotundatis vel obtusis raro subacutis 5–10.5 cm longis 3–5.5(–8) cm latis revolutis, supra rugulosis nervis lateralibus costa mediaque sulcatis glabris costa media sulcata parce strigillosa excepta, subtus nervis lateralibus costa mediaque moderate strigillosis nervis lateralibus magis hispidulis pilis 0.2–0.3 mm longis instructis superficie ipsa ut videtur glabratis at venulis tertiariis strigilloso-hispidulis pilis pallidis 0.2–0.3 mm longis instructis subtus obsolete rugulosa vel reticulato-venulosa, marginibus adpresso-ciliatis; nervis lateralibus utroque latere 7–11; inflorescentiis in anthesi 2.5–4 cm longis in fructu ad 7 cm longis, pedunculo in anthesi 1–2 cm longo in fructu 3–4.5 cm longo, rhachidi dense hirtella, glomerulis 3–4 sessilibus axibus lateralibus nullis; florum bracteis late triangulari-ovatis vel ovatis subacutis 1.5–2 mm longis basi marginibusque hirtello-strigosis; calyce hypanthioque 2.25 mm longo apice 2.5 mm lato profunde campanulato; hypanthio glabro; calyce ca. 1.5 mm longo moderate adpresso-strigilloso pilis 0.2–0.3 mm longis instructis 4-lobato, lobis suborbiculari-late triangularibus rotundatis 0.3–0.5 mm longis 1 mm latis setuloso-ciliatis ciliis 0.4–0.5 mm longis; corolla cylindrico-campanulata 4.5–5 mm longa, tubo 2.5 mm longo basi 1 mm lato fauce 1.5 mm lato extus strigilloso parte basilari 1.5 mm glabra excepta, lobis 4 ovato-oblongis obtusis 2–3 mm longis 1.1–1.5 mm latis extus dense strigillosis intus villosulis; antheris oblongis rotundatis 0.8–1.2 mm longis sessilibus vel subsessilibus, filamentis brevissimis 0.2–1 mm longis glabris; stylo 3.5 mm longo glabro, stigmatibus rhomboideo-oblongis rotundatis 0.5 mm longis; fructibus ovato-oblongis 10 mm longis 6 mm latis.

Type. Climber; leaves dark green above, lighter beneath, stiff, brittle, curled; calyx green; corolla yellow; mature fruit purplish-black; scrub and low forest on shoulder of east flank, above Thompson Camp, Mount Ayanganna, Upper Mazaruni river basin, British Guiana, at alt. 1418–1525 m, 10–12 Aug 1960, *S. S. Tillett, C. L. Tillett & R. Boyan 45081* (holotype NY).

This species differs from *M. sarmentosa* in the long-ciliate calyx-lobes, prominently rounded calyx-lobes, short filaments, and hispidulous lower surface of the leaf-blades on the lateral and tertiary nerves.

20. **Malanea chimantensis** Steyermark, sp. nov.

Planta ligneosa volubilis, ramis apicalibus ferrugineo-hirtellis; stipulis late lanceolatis subacutis ad 7 mm longis basi medioque atque marginibus strigillosis; foliis petiolatis, petiolis 6–13 longis dense strigoso-hirtellis; laminis ovalibus vel late elliptico-oblongis apice rotundatis vel obtusis basi obtusis vel rotundatis ad subacutis 5–11 cm longis 3–7 cm latis, supra rugosis plerumque glabris vel subglabris costa media nervis lateralibusque sparse strigillosis exceptis sulcatis, subtus costa media nervis lateralibusque elevatis moderate stramineo-hirtellis pilis brevibus 0.3–0.4 mm longis instructis, superficie subtus moderate strigillosa pilis adpressis albidis 0.2–0.3 mm longis conspersis; inflorescentiis frugiferis 6–7.5 cm longis, pedunculo 2.5–3.5 cm longis, rhachidi dense breviter hirtella, glomerulis ca. 4 sessilibus; hypanthio extus glabro; calyce extus moderate strigilloso pilis 0.2–0.3 mm longis instructis eciliatis vel ciliatis ciliis 0.2–0.3 mm longis instructis; fructibus ovato-oblongis vel elliptico-oblongis 9–10 mm longis 5–8 mm latis.

Type. Dwarf forest on semi-open shoulder of northwestern part of Abacapá-tepui, Chimantá Massif, Estado Bolívar, Venezuela, at alt. 1400 m, 19 Apr 1953, *Julian A. Steyermark 75166* (holotype NY).

This species differs from *M. ciliolata* Steyerm. in the usually non-ciliate summit of the calyx and the denser, more uniform pubescence of the lower leaf surface, with denser shorter hairs. It has a leaf shape reminiscent of *M. sarmentosa* and the rugulose upper surface with sulcate midrib and lateral nerves is also suggestive of *M. sarmentosa,* but the lower surface does not show the raised papillate surface as in *M. sarmentosa* f. *sparsipilosa.* Instead, the lower surface itself is appressed-pubescent throughout as in *M. sarmentosa* f. *sparsipilosa.*

21. **Malanea setulosa** Steyermark, sp. nov.

Planta ligneosa volubilis, stipulis late lanceolatis acuminatis 9–12 mm longis extus dense strigillosis; foliis petiolatis, petiolis 8–20 mm longis dense castaneo-hirtellis; laminis oblongo- vel obovato-ellipticis apice hebiter acutis vel subacutis basi acutis vel obtusis 9–16 cm longis 3.8–7 cm latis, supra tenuiter rugulosis costa media nervis lateralibus paullo sulcatis vel nervis lateralibus solum impressis superficie sparse breviterque pubescenti costa media magis densiuscule strigillosa, subtus dense tomentosis costa media nervis lateralibusque dense hirsutulis vel hirtellis pilis ferrugineis instructis; nervis lateralibus utroque latere 11–13; inflorescentiis 8–13 cm longis, pedunculo 3–6.5 cm longo, rhachidi dense ferrugineo-hirtella pilis subadpressis, glomerulis 3–5 sessilibus, axibus lateralibus nullis; inflorescentiarum bracteis dense hirsutulis ciliatis; calyce hypanthioque 1.8–1.9 mm longo apice 1.5 mm lato; hypanthio glabro; calyce 1.5 mm longo extus minute strigilloso intus glabro 4-dentato, lobis late triangularibus acutis 0.2–0.5 mm longis 0.8–0.9 mm latis; corolla campanulato-infundibuliformi 5 mm longa, tubo 2 mm longo basi 0.7–0.8 mm lato fauce 1.8–2 mm lato extus dense strigoso intus villosulo, lobis 4 lanceolato-oblongis obtusis vel rotundatis 2.5–3 mm longis 1 mm latis apice atque infra apicem extus plurisetosis pilis rigidis multicellularibus ca. 0.5 mm longis instructis, extus dense strigosis intus villosulis; antheris ca. 1 mm longis, filamentis antheris brevioribus; stylo 4.5 mm longo glabro; stigmatibus rhomboideo-oblongis apice rotundatis; fructibus elliptico-oblongis 10–11 mm longis 4.5–5 mm latis.

Type. Vining; stems castaneous; leaves rugose, subcoriaceous, dark green above, gray green below or pale green; petioles ferruginous; corolla greenish; woods bordering stream tributary to Río Kukenan at base of Mount Roraima, Estado Bolívar, Venezuela, at alt. 1185–1280 m, 24 Sep 1944, *Julian A. Steyermark 58558* (holotype NY, isotypes F, VEN).

This species differs from *M. sarmentosa* in having the leaf-blades pointed at both ends, acutely pointed calyx-lobes, and the setulose-tipped corolla-lobes.

22. **Malanea eglerii** Steyermark, sp. nov.

Planta ligneosa volubilis, stipulis triangulari-lanceolatis acuminatis vel caudatis 6–9 mm longis 4–5 mm latis extus dense strigillosis; foliis petiolatis, petiolis 5–18 mm longis sparse vel moderate cano-strigillosis vel glabrescentibus; laminis obovatis vel oblongo-obovatis apice rotundatis vel acutate obtusis vel obtusis basi cuneatim angustatis acuminatis vel acutis 8.5–12.5 cm longis 4–6 cm latis, supra costa media nervis lateralibusque impressis subtus paullo elevatis, supra omnino glabris subtus costa media nervis lateralibus sparse remoteque adpresso-strigillosis pilis tenuibus 0.2–0.3 mm longis instructis, superficie subtus sparse adpresso-pubescentibus pilis remotis 0.2–0.3 mm longis instructis nervis tertiariis obsoletis vel nullis; nervis lateralibus utroque latere 4–6; inflorescentiis multiramosis 8–18 cm longis, pedunculo 6.5–8.5 cm longo, rhachidi ramisque dense cano-strigillosis, ramis 5–7 inferioribus elongatis infimis in fructu 1–5.5 cm longis superioribus brevioribus, glomerulis 2–4-floris; florum bracteis late ovatis acutis vel subacutis extus medio hirsutulis ciliatis; calyce hypanthioque 2.8 mm longo, hypanthio subcylindrico-profunde campanulato glabro; calyce 1–1.5 mm longo 4-lobato, lobis late triagulari-suborbicularibus subacutis vel subobtusis 0.5 mm longis 1 mm latis minute ciliolatis praeter sinus glabros exceptos extus plerumque glabris vel interdum remote puberulentibus pilis brevibus paucis instructis; corolla subcylindrico-subinfundibuliformi 6.8–7 mm longa, tubo 3 mm longo basi 1.8 mm lato fauce 2 mm lato extus glabro intus parte basilari 0.7 mm atque superne villoso alio glabro; antheris anguste oblongis obtusis 1.8 mm longis, filamentis 0.8 mm longis glabris; fructibus late oblongis apice angustatis 10–11 mm longis 5–6 mm latis.

Type. Liana; fruit green, maturing purplish brown; in forest near first cachoeira on Rio Iaue, 2° 53′ N, 52° 22′ W, 0.5 km east of confluence with Rio Oiapoque, Territorio Amapá, Brazil, 22 Aug 1960, *W. A. Egler & J. M. Pires et al. 47729* (holotype NY).

From *M. obovata* Hochr. and *M. schomburgkii* Steyerm. this species differs in the obovate leaf-blades broadly rounded in the upper half with obtuse instead of acute or acuminate apices, sparingly short-strigillose lower surface, midrib, and nerves of the leaf-blades, larger corollas, longer styles, longer peduncle of a much more branched inflorescence with longer lateral axes, more uniformly ciliolate calyx-lobes, and fewer lateral pairs of leaf nerves. Its affinity with the *M. obovata* group is shown by the glabrous outer surface of the corolla-tube, nearly glabrous calyx, and nearly glabrous lower surface of the leaf-blades. From *M. martiana* M. Arg. of Bahía, Brazil and elsewhere in Brazil, it differs in the lower half of the corolla glabrous and the uniformly minutely ciliolate calyx-lobes.

23. **Malanea obovata** Hochr. Bull. N. Y. Bot. Gard. **6**: 289. 1910.

M. angustifolia Bartl. in Schomb. Fauna & Fl. Brit. Guian. 947. 1848, *nomen nudum.*
M. roraimensis Wernh. Jour. Bot. **50**: 243. 1912, type: Roraima, 1842–43, *Schomburgk 1002.*

Type. Roraima, British Guiana, 1842–43, *Schomburgk 1002* (holotype K, isotype NY, US).

Distribution. BRITISH GUIANA. Upper Mazaruni river, long. about 60° 10′ W, 22 Sep–6 Oct 1922, *De La Cruz 2277;* Membaru Creek, Upper Mazaruni river, 14 Feb 1939, *Pinkus 218;* Potaro River below Tukeit, base of Kaieteur escarpment, *Maguire & Fanshawe 23500;* Roraima, *Schomburgk 1002* (holotype).

Sandwith (Kew Bull. **1948**: 260. 1948) has already noted that *M. roraimensis* Wernh. is a synonym of *M. obovata* Hochr., both names being based upon the same specimen of *Schomburgk 1002.* In the case of *M. roraimensis* two different specimens were cited, *Schomburgk 1002* having been cited first and *Schomburgk 159* (299) following in order. The name *M. angustifolia* Bartl. is a *nomen nudum,* merely stating "An den Ufern des Demerara. Blüht im Abril. Windender Strauch." *Malanea obovata* is the first legitimately published name with description, antedating by two years the publication of Wernham.

24. **Malanea schomburgkii** Steyermark, nom. nov.

M. glabrescens Bartl. (as "glaberescens") in Schomb. Fauna & Fl. Brit. Guian. 947. 1848, *nomen nudum.*

Planta ligneosa, stipulis ovato-lanceolatis acuminatis vel subcaudatis 9–11 mm longis basi 4–5 mm latis basi medioque strigosis aliter glabris; foliis petiolatis, petiolis 5–10 mm longis glabris vel supra pilis paucis remotis scabridulis instructis; laminis subovato-ellipticis vel elliptico-oblongis apice subacuminatis subacutis

vel hebiter acutis ad rotundatis basi obtusis rotundatis vel paullo acutis 5–9.5 cm longis 2–4.8 cm latis supra conspicue sulcatis utrinque glabris marginibus paullo ad valde revolutis; nervis lateralibus utroque latere 8–11; inflorescentiis 4.5–8.5 cm longis, pedunculo 1.5–4 cm longo, rhachidi dense breviter substrigillosa vel subhirtella, glomerulis 4–6 inferioribus 2–3 cum axibus lateralibus 4–15 mm longis; calyce hypanthioque 1.7–1.8 mm longo apice 1.7–1.8 mm lato subcampanulato, hypanthio extus glabro; calyce 0.5–0.9 mm longo prominente 4-lobato, lobis late ovato-suborbicularibus rotundatis 0.2–0.5 mm longis 0.7 mm latis utrinque glabris eciliatisque vel interdum extus breviter strigillosis atque pauciciliolatis; corolla 4.5–5.5 mm longa, tubo 1.7–3 mm longo basi 0.8–1 mm lato fauce 2 mm lato extus glabro intus villosulo, lobis ovato-oblongis obtusis vel rotundatis 2.2–2.5 mm longis 1.1–1.2 mm latis extus sparse adpresso-strigillosis pilis 0.2–0.25 mm longis instructis vel partim glabratis intus villosulis; antheris oblongis rotundatis 0.8–1 mm longis sessilibus vel subsessilibus, filamentis obsoletis ca. 0.1–0.5 mm longis glabris; stylo 2.5 mm longo glabro.

Type. Barima River, British Guiana, *Rob. Schomburgk 229* (holotype K, fragment F, photo from B at F, NY).

Distribution. BRITISH GUIANA. Barima River, *Schomburgk 229* (holotype). Paratypes. Vicinity of Wismar, Demerara River, lat. 6° N, 12–16 Oct 1922, *J. S. De La Cruz 2413* (NY, US); Upper Rupununi River, near Dadanawa, lat. 2° 45′ N, 24–29 Jul 1922, *De La Cruz 1738* (NY, US).

The above description is based on an examination of a fragment of the type collection at F, of the photograph of the holotype, and matching collections from British Guiana cited above. The *De La Cruz 2413* specimen, with the base of the leaf-blades varying from acute to obtuse or rounded, matches the *Schomburgk* specimen. The leaf-blades of the *Schomburgk* specimen have only slightly subrevolute margins, matched by the *De La Cruz 1738* collection, whereas in the *De La Cruz 2413* collection the margins are strongly revolute. The apex of the blades vary from obtusely acute or subacute in the *Schomburgk* specimen, abruptly acute to subacuminate in the *De La Cruz 1738* collection, to rounded in the *De La Cruz 2413* collection. The calyx is glabrous and eciliate in the *Schomburgk* specimen, whereas in the *De La Cruz* collections the calyx varies from glabrous to sparsely remotely strigillose below the apex and eciliate to sparsely ciliate with a few hairs. In all specimens examined the lowest two tiers of the inflorescence are on lateral axes.

The *Schomburgk 229* specimen, upon which the name *M. glabrescens* Bartl. was based, represents a distinct taxon when compared with the *Schomburgk 1002* collection, upon which *M. obovata* Hochr. (*M. roraimensis* Wernh.) was based. Besides the differences presented in the key to the species, *M. obovata* has the leaf-blades principally oblanceolate and broadest above the middle, whereas those of *M. schomburgkii* are chiefly elliptic-oblong or oblong- or subovate-elliptic and broadest around the middle; moreover, in general the leaf-blade in *M. obovata* is cuneately narrowed to an acute or subacute base, whereas in *M. schomburgkii* it is more usually rounded or obtuse at the base, but sometimes is also subacute to even acute. The prinicipal differences are found, however, in the sulcation and number of lateral nerves of the leaf-blades, the revolute nature of the leaf-margins, and the length of the corolla.

25. Malanea microphylla Standley & Steyermark, Fieldiana Bot. **28**: 582. 1953.

Type. Sprawling shrub or semi-climbing with elongated branches; corolla greenish-white; fruit turning black-purple, elliptic; upper slopes, Carrao-tepui, Estado Bolívar, Venezuela, at alt. 2130–2430 m, 7 Dec 1944, *Julian A. Steyermark 60875* (holotype F).

Distribution. Sandstone table mountains, Estado Bolívar, southeastern Venezuela.

In addition to the type collection, the following specimens have been examined: northwestern part of summit of Abapacá-tepuí, Chimantá Massif, at alt. 2125–2300 m, *Steyermark 74894;* central section bordering *zanjon* between rocky ledges above Summit Camp, between Middle and Upper Falls of Río Tirica, Chimantá Massif, at alt. 1925–1940 m, *Steyermark & Wurdack 384;* Cerro Apacará, at alt. 2100–2300 m, *Cardona 1558, 1966;* northwest cumbre, Churi-tepuí (Muru-tepuí), Chimantá Massif, at alt. 2100–2200 m, *Wurdack 34188.*

This species possesses the smallest leaves of any species of the genus. Its closest relative appears to be *M. obovata* Hochr.

Tribe Psychotrieae

A study of the various taxa which have been assigned in the past to the genus *Pagamea* reveals the fact that four generic elements, apparently unrelated, are involved. In true *Pagamea* the fruit consists of a fleshy drupe comprising two pyrenes conspicuously exserted from the calyx. In the other three genera, which have been previously included within *Pagamea,* the fruit is dry with a crustaceous-osseous pericarp. Besides the fundamental difference in type of fruit, there are distinct contrasts in the stipules and flowers. Among the genera segregated from *Pagamea* differences are found in the position of the ovary, number of cells of the ovary, number of ovules within the ovary, number of seeds in the fruit, type of dehiscence of fruit, and differences in corolla and calyx.

In the following key, these differences have been brought out.

Key to *Pagamea* and Segregate Genera

1. Flowers white, greenish, or creamy; fruit a fleshy drupe consisting of two pyrenes conspicuously exserted from calyx; terminal and uppermost stipular sheaths more or less persistent, those below deciduous; summit of stipular sheath with 4–8 setae. *Pagamea.*
1. Flowers blue, lavender, or purplish; fruit with a dry crustaceous-osseous pericarp; stipular sheaths all persistent; summit of stipular sheath with a multiple fringe of trichomes.
  2. Hypanthia more or less adherent or united with one another. *Pagameopsis.*
  2. Hypanthia completely free.
    3. Ovary completely inferior, 1-celled with 1 erect basal ovule; fruit indehiscent, enclosed by the calyx, 1-seeded; calycine glands present and conspicuous in the interior sinus between each of the calyx-lobes; corolla lobes 5, densely villosulous within; leaves silvery-sericeous throughout. *Aphanocarpus.*
    3. Ovary only slightly inferior or nearly superior, 2-celled with 6–8 ovules on axile placentation (weakly 2-celled at base, the cell partition sometimes not apparent); fruit septicidally dehiscent, exserted from the calyx, eventually splitting into 4 valves, 2–4-seeded; calycine glands absent; corolla-lobes 4, papillate in upper half; leaves not sericeous. *Coryphothamnus.*

Aphanocarpus Steyermark, gen. nov.

Frutex humilis. Stipulae persistentes, vaginis apice multifimbriatis. Folia lineari-spathulata vel anguste lineari-oblanceolata utrinque dense sericeo-pubescentia. Calycis lobi in sinu interiori inter lobos 1–3 glandulis subulatis instructi. Corollae coeruleae purpureae vel lavendulae, lobis 5 intus dense villosulis. Ovarium inferum uniloculare ovulum 1 erectum basilare anatropum. Fructus monospermus non dehiscens siccus intus chartaceus osseus unilocularis ab hypanthio calyceque inclusus. Semen solitarium unum.

Typus: *Aphanocarpus steyermarkii* (Standl.) Steyermark.

The name is taken from Greek, *aphanes,* hidden, and *karpos,* carpel.

1. **Aphanocarpus steyermarkii** (Standl.) Steyermark, comb. nov. Fig. 36, A, B.

Pagamea steyermarkii Standl. Fieldiana Bot. **28**: 589. *fig. 131.* 1953.

Type. On big boulders, *Bonnetia roraimae* forest on southwest-facing shoulder, Ptari-tepui, Estado Bolívar, Venezuela, at alt. 2000–2200 m, 2 Nov 1944, *Julian A. Steyermark 59744* (holotype F).

Distribution. Known only from sandstone table mountains at alt. 2000–2500 m, in Estado Bolívar, southeastern Venezuela. VENEZUELA. Ptari-tepuí, *Steyermark 59744* (holotype), *59770* (paratype); Carrao-tepuí, *Steyermark 60899* (paratype); east-central portion of summit of Apácara-tepuí, Chimantá Massif, *Steyermark 75900, 75901;* upper part of upper cumbre, northwest cumbres, Churi-tepuí (Muru-tepuí), Chimantá Massif, *Wurdack 34302, 34173;* Chimantá-tepuí, Chimantá Massif, *Steyermark & Wurdack 663;* Auyán-tepuí, *Vareschi & Foldats 4965.*

Although the illustration accompanying the original description shows a two-celled ovary with a single ovule arising at the base of each cell, subsequent dissections have revealed only a one-celled ovary with a single ovule. At the time of the original description no fruiting specimen was available. Fruiting specimens have now been examined from the following: *Vareschi & Foldats 4965, Steyermark & Wurdack 663, Wurdack 34302.* Since the fruit and seed have not previously been described, the following description is given herewith:

Fructus 1.5–2 mm longus 1 mm latus, loculo chartaceo nitido; semine 1 subtrigono obovoideo extremitatibus rotundatis obtusisque 1.25–1.5 mm longis 0.75–1 mm latis stramineis, superficie tenuiter leviterque cellulari-punctulatis.

Coryphothamnus Steyermark, gen. nov.

Frutex humilis. Stipulae persistentes, vaginis apice multifimbriatis. Folia lineari-lanceolata subtus marginesque pilosa. Calyx intus sine glandulis. Corollae coeruleae purpureae vel lavendulae, lobis 4 intus supra medium papillatis. Ovarium fere superum vel semi-inferum biloculare, plerumque 4-lobatum saltem infra medium basique cum dissepimento tenui fere uniloculare, ovulis 6–8 in placenta axilla insidentibus. Fructus 2–4-spermus ab apice septicide dehiscens siccus osseus primum in 2 valvas demum in 4 valvas fissus, ab calyce exsertus. Semina 2 vel 4 rugulosa.

Typus: *Coryphothamnus auyantepuiensis* (Steyerm.) Steyermark.

The name is taken from Greek, *koryphe,* head, and *thamnus,* shrub.

Coryphothamnus auyantepuiensis (Steyermark) Steyermark, comb. nov. Fig. 36, C–H.

Pagamea auyantepuiensis Steyermark, Fieldiana Bot. **28**: 584. *fig. 129.* 1953.

Type. Mount Auyán-tepuí, Estado Bolívar, Venezuela, at alt. 2200 m, Dec 1937–Jan 1938, *G. H. H. Tate 1365* (holotype NY).

Distribution. Known only from Auyan-tepui, at alt. 2200–2300 m, in Estado Bolívar, southeastern Venezuela. VENEZUELA. *Tate 1365* (holotype); en pe-

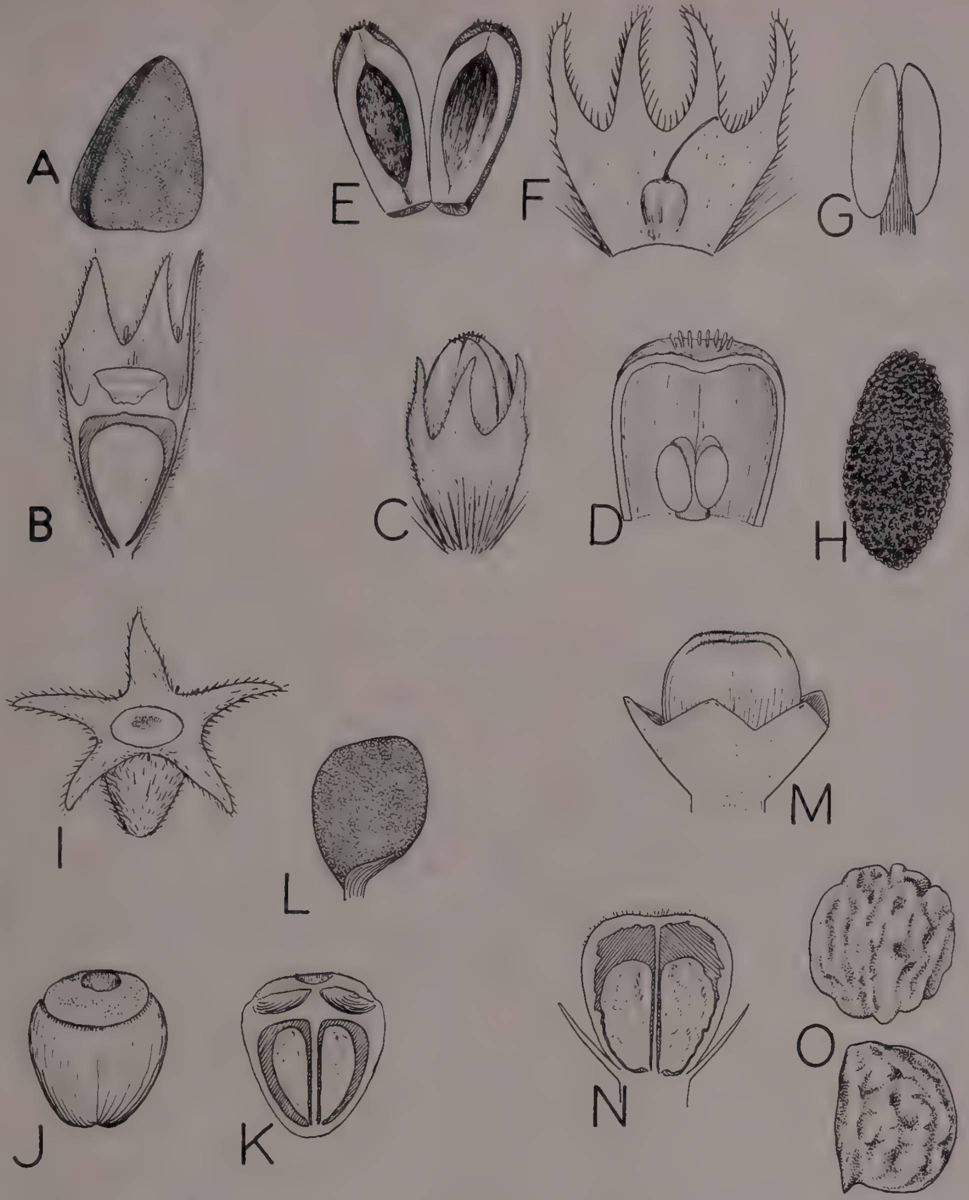

FIG. 36. A–B, *Aphanocarpus steyermarkii.* A, seed, × 15. B, vertical section through calyx and hypanthium in fruiting stage, showing single seed in position, × 10. C–H, *Coryphothamnus auyantepuiensis.* C, fruiting stage, showing calyx with exserted fruit, × 20. D, vertical section through ovary, showing 4 ovules on central placenta, × 20. E, dehiscent half of fruit, splitting, × 5. F, calyx and ovary, interior view, × 5. G, stamen, × 7. H, seed, × 7. I–K, *Pagameopsis maguirei* subsp. *maguirei.* I, fruiting stage, with calyx and hypanthium, × 5. J, fruiting hypanthium, with calyx removed, × 10. K, vertical section through fruiting hypanthium, × 10. L, seed, × 20. M–O, *Pagamea guianensis.* M, fruiting calyx with exserted fruit, × 2. N, vertical section through fruit and calyx, × 2. O, seed, two views, × 2.

queñas grietas en la parte superior del plató, *Vareschi & Foldats 4930;* en los cañones de la parte superior, *Vareschi & Foldats 4899; Pannier & Schwabe;* cumbre de la parte suroeste, vecindad de gran roca de arenisca con cueva, noroeste de "Oso Woods Camp," *Steyermark 93200;* cumbre de la parte sur, entre "Oso Woods Camp" y "Libertador," *Steyermark 93934.*

At the time of the original description the fruit was unknown. The following description of the fruit and seeds is drawn from the specimens of *Vareschi & Foldats 4930* and *Pannier & Schwabe,* together with an emended description of the flowers, based upon the examination of additional material now available.

Pedunculus 16–23 cm longus; calycis lobis 3–5, 2.8–4 mm longis; corolla 5.7–8 mm longa, tubo 2–4.5 mm longo, lobis 3–3.5 mm longis 1.2–1.5 mm latis; ovario 1 mm alto 2 mm lato plerumque 4-lobato glabro apice truncato; stylo 2.5–5 mm longo glabro praeter 20 glandulas cylindricas sessiles basi exceptas; fructu osseo nitido ovoideo negro 3.5–4 mm longo ad hypanthium parte basilari 1.5 mm adnato supra lobos calycis libero apice pilis papillatis persistentibus instructo; seminibus 2 vel 4 negris carnosis primum verticaliter faciebus interioribus conjunctis deinde disjunctis rugulosis immaturis 2.5 mm longis 1.5 mm latis.

The ovary is only slightly inferior or nearly free. Although 2-celled, the dissepiment is thin and weakly developed, easily breaking and presenting an apparently but falsely 1-celled ovary. The 6–8 ovules are borne on axile placentae.

Dr. Richard S. Cowan, after studying the specimen of *Tate 1365* (holotype of *Coryphothamnus auyantepuiensis*), concluded that the ovary was 2-celled with 3 axile ovules in each cell. The capsule at first is 2-celled, but soon splits into 4 sections. It is adherent to the basal 1.5 mm of the lower part of the hypanthium, but free above the calyx-lobes. The 2 or 4 seeds, apparently arising at the base of the cell, are attached together vertically by their inner faces. The capsule dehisces septicidally, opening from the summit downward into two main valves, which eventually split into four sections or divisions.

It is interesting to note here that Dr. Cowan independently reached the conclusion that the *Tate 1365* specimen belonged to an undescribed genus related to *Pagamea.* It seems noteworthy to quote from his notes of July, 1956 attached to the holotype specimen: "This plant was originally thought to be a *Pagamea,* but the placentation makes this somewhat dubious. The ovary is superior here as in that genus but in the other species described in the last few years the ovary varies from completely superior to completely inferior in the various species. The latter are however all 2-celled with uniovulate cells (as for *Pagamea*). The 3 axile ovules in each cell of the Tate collection [2-celled ovary] does not fit *Pagamea* at all and if it is included in *Pagamea* by emending the generic characters, then might not the genus be also emended to include those species described in *Pagamea* which have inferior ovaries or 1/2-inferior ovaries? If so, then how will species of inferior ovaries be separated from other genera with inferior ovaries? Furthermore, *P. steyermarkii* has a uniovulate 1-celled ovary which must be considered as inferior, although admittedly the union between the calyx and ovary may be broken. I have concluded that *Tate 1365* probably is not *Pagamea,* but that it may represent a new genus allied to *Pagamea.* I have searched through the Rubiaceae, Loganiaceae, etc. and still feel that is rubiaceous in its affinities but even this is uncertain."

Now that specimens are known with fruit, it is obvious that the taxon from Auyan-tepui is generically distinct, not only from *Pagamea* Aubl. proper, but as well from *Aphanocarpus steyermarkii* (formerly placed in *Pagamea*).

Pagameopsis Steyermark, gen. nov.

Frutex humilis. Stipulae persistentes, vaginis apice multifimbriatis. Hypanthii plus minusve connati. Calycis lobi in sinu interiori inter lobos plerumque una glandula carnosa instructi. Corollae coeruleae purpureae vel lavendulae, lobis 5 intus dense villosulis. Ovarium inferum 2-loculare, ovulum in quoque loculo 1 erectum basilare. Fructus 2-spermus non dehiscens osseus rigidus siccus 2-locularis ab hypanthio calyceque inclusus. Semina 2 calva.

Typus: *Pagameopsis garryoides* (Standl.) Steyermark.

Key to the Species of *Pagameopsis*

1. Inflorescence congested with 3–5 main clusters, only the principal branches of the inflorescence manifest; petiolar base moderately to densely hirsutulous throughout; stipular sheath densely strigose throughout with cinereous pubescence; leaves 1-2/3–3-1/5 times as long as broad, the leaf surface (excluding midrib) pilose to glabrous beneath. 1. *P. garryoides.*

1. Inflorescence manifestly ramulose, of 7 or more principal branches, the ultimate branchlets conspicuous; petiolar base short-strigose throughout or glabrous above and sparsely pilose beneath; stipular sheath pale brown to ferruginous-ciliate at summit, sparsely to moderately pale brown- to ferruginous-strigose in upper part, mostly glabrate below; leaves usually (2-7/8–)3–6 times as long as broad, the leaf surface (excluding midrib) glabrous beneath. 2. *P. maguirei.*

1. Pagameopsis garryoides (Standley) Steyermark, comb. nov.

Pagamea garryoides Standl. Field Mus. Bot. Ser. 7: 420. 1931.

Type. Rocks above Caño Negro, Savanna Hills, Mount Duida, Territorio Federal Amazonas, Venezuela, at alt. 1272 m, Aug 1928–Apr 1929, *G. H. H. Tate 819* (holotype NY).

Distribution. Southern Venezuela, at elevations of 1275–2300 m, on sandstone table mountains in Territorio Federal Amazonas (Duida, Huachamacari, Parú, and Yutaje), and locally on Ilu-tepuí in Estado Bolívar.

The calyx-lobes vary from 4–6 and generally possess a single dark gland in the sinus at the base of the calyx-lobes. The leaves vary in shape from ovate or ovate-elliptic to oblong-elliptic, oblong-obovate or oblong-oblanceolate, in length from 2–5.5 cm long, and in width from 1–2 cm.

2. Pagameopsis maguirei Steyermark, sp. nov.

Frutex ad 2-metralis, stipularum vaginis inferne plerumque glabris superne sparse vel moderate strigosis pilis pallido-brunneis vel ferrugineis instructis apice ciliatis pilis pallido-brunneis vel ferrugineis; foliis plerumque ad apices ramorum confertis, breviter petiolatis, petiolis obsoletis vel decurrentibus cum laminis 2–8 mm longis 1.5–3 mm latis; glabris vel subtus sparse pilosis ad utrinque hirtellis vel strigillosis; laminis basi decurrentibus elliptico-oblongis vel oblanceolatis ad sublineari-oblanceolatis apice obtusis vel acutis basi acutis vel obtusis 2.7–10 cm longis 0.7–2 cm latis coriaceis supra glabris vel glabrescentibus nitidis, subtus argenteis vel pallidis costa media plerumque sparse vel moderate pilosula aliter glabris, 2-7/8–6-plo longioribus quam latioribus, marginibus apicibus ciliatis; nervis lateralibus obsoletis vel tenuiter utroque latere 4 erecto-adscendentibus; inflorescentiis 5–11 cm longis subhemisphaericis, pedunculo rhachidique atque ramis dense hirtellis, ramis primariis tribus, ramis secundariis tribus paniculate ramosis 1–3 cm longis, ramulis ultimis manifestis numerosis tenuibus 4–5 mm longis,

ramusculis ad apices glomerulos 3–4-flores ferentibus; inflorescentiae bracteis ultimis spathulatis vel lineari-ellipticis 3–4 mm longis 0.5–1 mm latis hirtellis ciliolatis; calyce 3.5–4.5 mm longo, tubo campanulato 1.5–2 mm longo extus dense breviter hirtello intus pilosulo-hirtello inaequaliter 5–6-lobato, laciniis oblongo- vel ovato-lanceolatis vel late oblongis obtusis vel rotundatis ad subacutis 1–2.5 mm longis 0.5–1.5 mm latis extus sparse vel dense hirtellis intus strigosis vel dense hirtellis saepe basi dense pilis longioribus pilosis, in sinubis inter lobos cum una glandula nigra munitis; corolla breviter hypocrateriformi 4–5 mm longa, tubo 2–2.25 mm longo basi 1.1–1.5 mm lato fauce 1.5–2 mm lato extus moderate vel dense hirtellis parte basilari 0.75–1.5 mm glabra excepta intus villosulo basi 0.75–1.5 mm glabra excepta, lobis lanceolatis obtusis apice cucullato-inflexis patentibus 2–3 mm longis 0.7–1.25 mm latis extus moderate vel dense hirtellis intus dense villosulis; antheris lineari-oblongis paullo exsertis 1–1.3 mm longis, filamentis 1–1.5 mm longis glabris; stylo 2.75–4 mm longo glabro superne papillato excepto deorsum angustate alato, stigmate subcapitato leviter bilobato; ovario apice atque infra apicem breviter puberulo vel hirtello aliter glabro; fructibus subglobosis apice truncatis 1.8–2 mm longis 2 mm latis, loculis osseo-chartaceis; seminibus ovali-obovoideis stramineis vel pallido-brunneis rotundatis vel obtusis 1 mm longis 0.8 mm latis subtrigonis obtuse angulatis, superficie tenuiter puncticulatis.

Key to the Subspecies and Varieties of *Pagameopsis maguirei*

1. Petiolar base short-strigose throughout; calyx-lobes densely short-hirtellous within, densely cinereo-hirtellous without, the hairs conspicuously spreading, up to 0.3 mm long; corolla-lobes ca. 2 mm long, 1–1.25 mm wide. subsp. ***maguirei.***
1. Petiolar base glabrous above, glabrous to sparsely pilose beneath; calyx-lobes shortly strigose within, densely short-hirtellous without, the hairs ascending, 0.1–0.2 mm long; corolla-lobes 2.2–3 mm long, 0.7–1 mm wide.
   2. Leaves elliptic-oblong to oblong-oblanceolate, 3–3-1/5 times as long as broad, 3–6.5 cm long, obtuse or subobtuse to subacute at base; midrib of lower leaf surface pilose in basal third; inflorescence about as broad as long, 2.5–5.5 cm long, 2.5–4.5 cm broad. subsp. ***neblinensis*** var. ***neblinensis.***
   2. Leaves oblanceolate to sublinear-oblanceolate, 4–6 times as long as broad, 6.5–10 cm long, gradually acute to base; midrib of lower leaf surface glabrous to slightly pilose; inflorescence longer than broad, 6–10 cm long, 5–6 cm broad. subsp. ***neblinensis*** var. ***angustifolius.***

2a. Pagameopsis maguirei subsp. **maguirei.** Fig. 36, I–K. Fig. 37, A–D.

Lamina foliorum lanceolato-elliptica vel elliptica, petiolis basi ubique breviter strigosis; calycis lobis extus dense cinereo-hirtellis pilis manifeste patentibus ad 0.3 mm longis instructis, intus dense breviter hirtellis; corollae lobis ca. 2 mm longis 1–1.25 mm latis.

Type. Shrub 1.5–2 m; leaves deep green above, silvery below; calyx lilac; corolla deep lavender; stigma greenish-white; stem and peduncle dull purple; frequent in open dwarf forest, north-facing slopes on summit above valley of Caño Mojado, Torono-tepui, Chimantá Massif, Estado Bolívar, Venezuela, at alt. 2030–2150 m, 21 Feb 1955, *Julian A. Steyermark & John J. Wurdack 1020* (holotype NY, isotype VEN). Paratypes. *Bonnetia* forest by lower sandstone outcrops, northwestern part of summit of Abácapa-tepuí, Chimantá Massif, at alt. 2125–2300 m, *Steyermark 74906;* cumbre del cerro Apacará, at alt. 2100 m, *Cardona 1561;* Cerro Apacará, at alt. 2100 m, *Cardona 1971;* cumbre de la parte norte de la sección sur, Auyán-tepuí, at alt. 1660 m, *Steyermark 93767.*

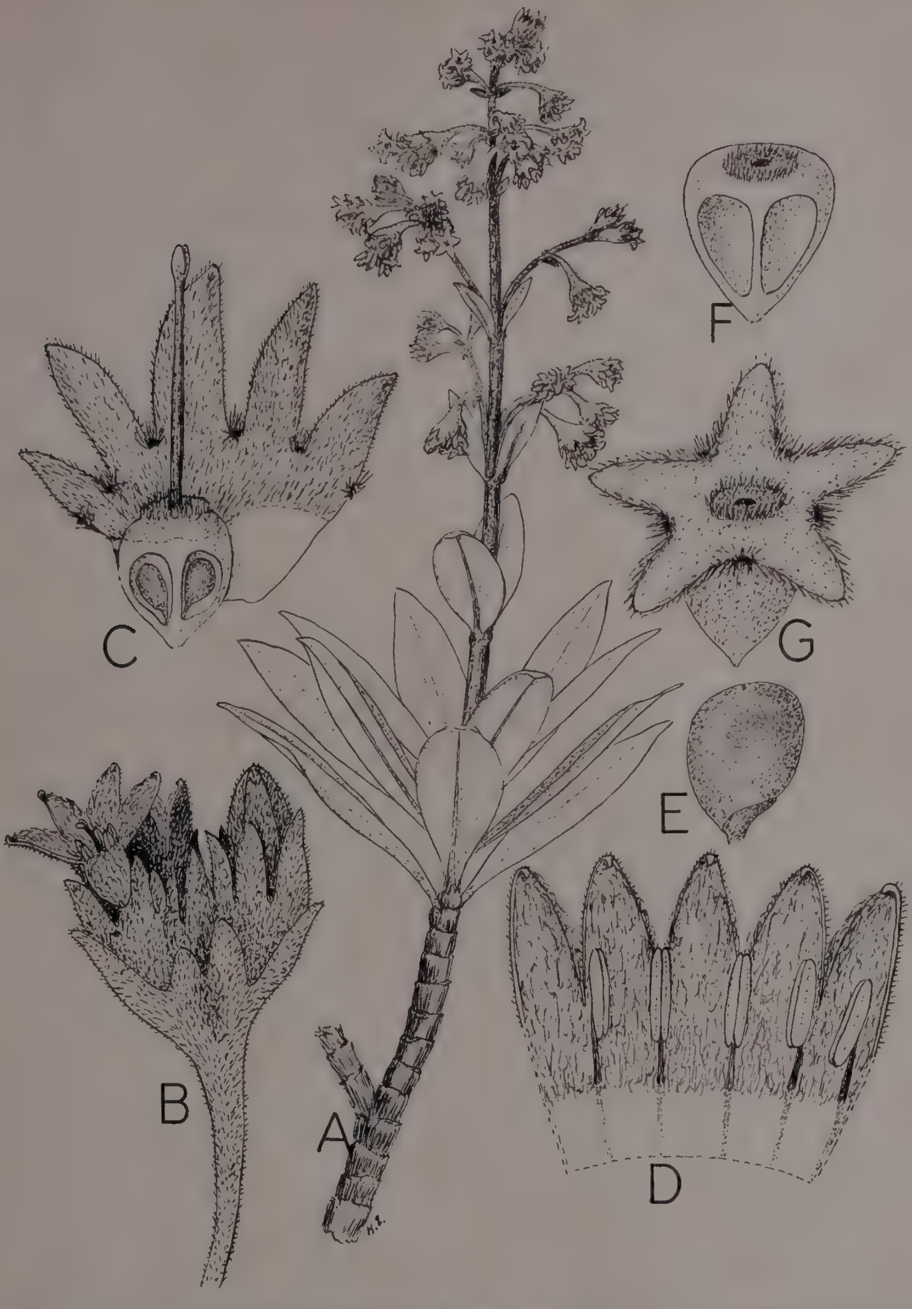

FIG. 37. A–D, *Pagameopsis maguirei* subsp. *maguirei*. A, habit of flowering branch, × 1. B, single flower-cluster at tip of branchlet of inflorescence, × 5. C, calyx, hypanthium, and vertical section of ovary, with portion of calyx-tube detached, inerior view, × 10. D, corolla, interior view, × 10. E–G, *Pagameopsis maguieri* subsp. *neblinensis* var. *neblinensis*. E, seed, × 15. F, hypanthium and ovary, vertical section, in fruiting stage, × 10. G, fruiting stage with calyx and hypanthium, × 10.

2b. Pagameopsis maguirei subsp. **neblinensis** Steyermark, subsp. nov.

A subsp. *maguirei* differt petiolis basi supra glabra subtus glabra vel sparse pilosa; calycis lobis extus dense breviter hirtellis pilis adscendentibus 0.1–0.2 mm longis instructis, intus breviter strigosis; corollae lobis 2.2–3 mm longis 0.7–1 mm latis.

2b′. Pagameopsis maguirei subsp. **neblinensis** var. **neblinensis.** Fig. 37, E–G.

Folia elliptico-oblonga vel oblongo-oblanceolata 3–6.5 cm longa 1–2 cm lata basi obtusa vel subobtusa ad subacuta 3–3-1/5-plo longiora quam latiora, costa media subtus parte basilari tertia pilosa; inflorescentiae longitudine latitudinem ca. aequanti 2.5–5.5 cm longa 2.5–4.5 cm lata.

Type. Shrub 0.3–0.8 m; inflorescence pink-purple; flowers pale purple; frequent in savanna 5 km west of Cumbre Camp, summit, Cerro de la Neblina, Territorio Federal Amazonas, Venezuela, at alt. 1900 m, 6 Jan 1954, *Bassett Maguire, John J. Wurdack & George Bunting 37130* (holotype NY). Paratype. Same locality, open headland 8 km north of Cumbre Camp, *Maguire, Wurdack & Bunting 37199* (NY).

2b″. Pagameopsis maguirei subsp. **neblinensis** var. **angustifolius** Steyermark, var. nov.

A var. *neblinensis* differt laminis foliorum oblanceolatis vel sublineari-oblanceolatis 6.5–10 cm longis 0.7–2 cm latis sensim ad basin acutis 4–6-plo longioribus quam latioribus, costa media subtus glabra vel paullo pilosa; inflorescentia longiori quam latiori 6–10 cm longa 5–6 cm lata.

Type. Spreading shrub 1–1.5 m; flowers pale purple; lowland and slope forests, frequent on upper escarpment slopes east of Camp 3, Cerro de la Neblina, Territorio Federal Amazonas, Venezuela, at alt. 1700 m, 27 Dec 1953, *Bassett Maguire, John J. Wurdack & George Bunting 36948* (holotype NY, isotype VEN). Paratypes. Upper escarpment slopes east of Camp 3, Cerro de la Neblina, *Maguire, Wurdack & Bunting 36835;* summit, trail escarpment, Cerro de la Neblina, at alt. 1800–1900 m, *Maguire, Wurdack & Maguire 42119.*

Pagamea Aubl. Pl. Guian. **1**: 112. *t. 44.* 1775.

Type species. *P. guianensis* Aublet.

Trees or shrub. Stipules united into a cylindrical sheath with usually several to many setae at the summit. Inflorescences axillary or terminal, pedunculate or sessile, subcapitate, subracemosely, paniculately, or thyrsoidly arranged, 1-many-flowered. Flowers white, greenish, or creamy. Calyx variously 4–5-toothed or lobed, sometimes truncate at apex. Corolla subrotate to cylindric, 4–5-lobed, densely villosulous within. Stamens 4–5, inserted in the throat. Ovary superior, 2-celled, with a solitary ascending ovule in each cell. Fruit a fleshy drupe containing two pyrenes conspicuously exserted from calyx.

Distribution. Chiefly northeastern South America south to Amazonas, Brazil and west to Amazonian eastern Colombia and eastern Peru.

Key to the Species of *Pagamea*

1. Flowers or fruits in a terminal sessile head without a common peduncle. 23. *P. sessiliflora.*
1. Flowers or fruits on a common peduncle, or, if rarely without peduncle, arising laterally from the uppermost leaf axils.

2. Foliage conspicuously hirsute with hairs 1–3 mm long; calyx densely hirsute without, the hairs up to 1 mm long.
   3. Peduncle 2.5–9.5 cm long; inflorescence elongated, 4–15 cm long; upper part of stem rufous-hirsute; upper leaf surface between nerves hirsute with hairs 1–2.5 mm long; stipule sheath densely hirsute. 5. *P. hirsuta.*
   3. Peduncle 1 cm long; inflorescence abbreviated, 2 cm long; upper part of stem strigillose; upper leaf surface between nerves glabrous; stipule sheath velutinous. 11. *P. duckei.*
2. Foliage glabrous or variously pubescent, but not long-hirsute; calyx glabrous or if variously pubescent, the hairs minute, less than 1 mm long.
   4. Lower surface of leaf-blade densely and softly pubescent.
      5. Leaf-nerves conspicuously sulcate above, 9–11; base of leaf-blade decurrent on petiole; inflorescence abbreviated, 2 cm long; peduncle 1 cm long; upper leaf surface glabrous between nerves; stipule sheath 13–22 mm long; corolla 7 mm long. 11. *P. duckei.*
      5. Leaf-nerves barely impressed above, not sulcate, 7–8; base of leaf-blade abruptly ending in petiole; inflorescence elongated, 3.5–9 cm long; peduncle 1.7–5 cm long; upper leaf-surface rough hirtellous above; stipule sheath 35–80 mm long; corolla 5.5 mm long. 4. *P. velutina.*
   4. Lower surface of leaf-blade glabrous or variously covered with indumentum, but not softly and densely pubescent.
      6. Inflorescence and fruiting clusters nearly or usually monocephalous, or the flowers uninterruptedly contiguous on two sides of the rachis.
         7. Ovary pubescent at summit. 14. *P. capitata.*
         7. Ovary completely glabrous.
            8. Corolla-tube 8–10 mm long, cylindric, 3–4 times as long as the lobes. 22. *P. magniflora.*
            8. Corolla-tube 1–2.2 mm long, rotate to subcampanulate, shorter than or at most equaling the lobes.
               9. Peduncle 1-flowered.
                  10. Leaf-blades beneath with barbate tufts along midrib; midrib of upper leaf surface glabrous. 21. *P. uniflora.*
                  10. Leaf-blades beneath without barbate tufts along midrib; midrib of upper leaf surface densely and minutely puberulent. 18. *P. pauciflora.*
               9. Peduncle 2-many-flowered.
                  11. Flowers spicately arranged in two elongated series on two sides of the rachis in an inflorescence longer than broad; peduncle conspicuously broadened upwards 2–4 mm broad. 15. *P. diceras.*
                  11. Flowers subcapitate in a subglobose or subhemispheric arrangement; peduncle not noticeably thickened upwards, or 1–2 mm broad.
                      12. Barbate tufts present along lower midrib of leaf-blade.
                          13. Two to three barbate tufts present along lower midrib of leaf-blade; apical 1/3–1/2 of interior of corolla-lobes glabrous to partly pilosulous along center; peduncles 2–9 mm long; heads 2–5-flowered. 20. *P. reducta.*
                          13. Four to eight barbate tufts present along lower midrib of leaf-blade; interior of corolla-lobes uniformly densely villosulous; peduncles mainly 11–38 (rarely 7–10) mm long; heads 7–10- or more-flowered.
                              14. Peduncles 11–13 mm long; exterior of corolla-lobes sparsely puberulent. 17. *P. duidana.*
                              14. Peduncles mainly 15–38 mm (rarely 7–13) long; exterior of corolla-lobes glabrous. 16. *P. standleyana.*
                      12. No barbate tufts present along lower midrib of leaf-blade.
                          15. Leaf-blades rounded or obtuse at base; peduncle none to 0.6 cm long. 19. *P. brevipedunculata.*
                          15. Leaf-blades acute to acuminate at base; peduncle 1–3 mm long.
                              16. Leaf-blades strongly revolute, broadly elliptic, obtusely to abruptly acute at apex; midrib of both upper and lower leaf surface densely and minutely puberulent; heads 1–5-flowered. 18. *P. pauciflora.*

16. Leaf-blades slightly or scarcely revolute, narrowly elliptic, or elliptic-lanceolate to elliptic-oblong, acute to subacuminate at apex; at least the upper midrib of the leaf-blade glabrous, the lower mostly so; heads 4–20- or more-flowered. 13. *P. montana.*

6. Inflorescence and fruiting clusters variously interrupted or branched.

17. Flowers and fruits spicately arranged in two elongated series on two sides of the rachis. 15. *P. diceras.*

17. Flowers and fruits variously arranged in spicate, thyrsoid, or paniculate inflorescences, but not spicate as two elongated series on two sides of the rachis.

18. Leaves rounded or obtuse at apex.

19. Calyx subtruncate at apex; teeth of stipule sheath 0.2–0.5 mm long; peduncle 2–2.5 mm broad. 8. *P. anisophylla.*

19. Calyx with deltoid or triangular-ovate acute or apiculately tipped manifest lobes; teeth of stipule sheath 1.5–4 mm long; peduncle 3–6 mm broad, conspicuously flattened. 1. *P. coriacea.*

18. Leaves acute or subacute to acuminate at apex.

20. Flowers or fruits arising from slender branched axes, the secondary branches ultimately branched and presenting a pedicellate appearance; calyx 0.3–2(–3) mm long, 0.5–2 mm broad. 9. *P. thyrsiflora.*

20. Flowers and fruit glomerules all sessile or the primary lateral axes of the inflorescence not branched nor presenting a pedicellate appearance; calyx mostly longer or broader.

21. Upper surface of leaves conspicuously sulcate-nerved.

22. Ovary glabrous; inflorescence 6–13 cm long; teeth of stipular sheath glabrous, 1 mm long; fruit glabrous, 1 mm long; fruit 8–10 mm long, 8–10 mm broad; leaves strongly coriaceous. 2. *P. plicata.*

22. Ovary setulose at summit; inflorescence 1.5–4 cm long; teeth of stipular sheath setulose-hispid, 3.5–6 mm long; fruit 5–6 mm long, 4 mm broad; leaves firmly membranous to subcoriaceous. 3. *P. plicatiformis.*

21. Upper surface of leaves not sulcate-nerved.

23. Ovary minutely puberulent or pilosulous at summit.

24. Leaf-blades 17–18 cm long, 6–8.5 cm broad; petioles 2.5–4.5 cm long; midrib and lateral nerves of upper and lower surfaces glabrous; younger stems glabrous. 10. *P. macrophylla.*

24. Leaf-blades 5.5–9 cm long, 1.2–2.5 cm broad; petioles 0.5–1.2 cm long; midrib of upper and lower surfaces densely puberulent; lateral nerves densely minutely puberulent on lower surface; younger stems densely puberulent. 6. *P. puberula.*

23. Ovary completely glabrous throughout.

25. Stipular sheath 17–32 mm long; inflorescence 10–26 cm long, 3.5–7 cm broad; peduncle 3.5–20 cm long, 3–6 mm broad; midrib 2–2.5 mm broad in lower half. 1. *P. coriacea.*

25. Stipular sheath 4–15 mm long; inflorescence 2.5–9 cm long, 1–3.5 cm broad; peduncle 1.2–6.5 cm long, 1–3 mm broad, not conspicuously flattened; midrib 0.5–1.5 mm broad throughout.

26. Midrib of upper leaf-surface densely pilosulous; midrib and lateral nerves of lower leaf surface densely pilosulous; calyx-tube hirtellous with spreading hairs up to 0.25 mm long; corolla-lobes sparsely strigose or hispidulous without; stipular sheath densely strigillose or hispidulous-puberulent; peduncle densely pilosulous. 7. *P. pilosa.*

26. Midrib of upper leaf-surface glabrous to minutely puberulent; midrib and lateral nerves of lower leaf surface glabrous to minutely pulverulent; calyx glabrous except for sometimes ciliolate margins; corolla-lobes glabrous or rarely minutely puberulent in lower half; stipular sheath glabrous to minutely puberulent; peduncle minutely puberulent.

27. Younger stems puberulent; axils of leaf-nerves on lower surface barbate; calyx-lobes glabrous; leaf-blades with 4–9 pairs of lateral nerves definitely manifest; inflorescence 5.5–12.5 cm long, 1.5–4 cm broad; peduncle 2.5–4.5 cm long; flower-clusters usually separated into two or more series or tiers, not monocephalous. 12. *P. guianensis.*

27. Younger stems glabrous; axils of leaf-nerves on lower surface glabrous; calyx-lobes sparsely puberulent to minutely ciliolate to glabrous; leaf-blades with scarcely discernible or nearly obsolete lateral nerves, if present 2–6 faint ones; inflorescence 2.5–5 cm long, 0.7–1.5 cm broad; peduncle 0.7–2.5 cm long; flower-clusters massed at summit, mainly monocephalous or at most forming 3 closely aggregate heads. 13. *P. montana.*

1. **Pagamea coriacea** Spruce ex Benth. Jour. Linn. Soc. **1**: 110. 1857; Prog. in Martius, Fl. Bras. **6**(1): 287. 1868.

Key to the Varieties of *Pagamea coriacea*

1. Apex of leaf acute. var. *acuta.*
1. Apex of leaf obtuse or rounded.
    2. Lower surface of leaf-blade with barbate axils of the nerves; calyx-tube abundantly hispidulous-puberulent without; corolla-lobes minutely hispidulo-papillose along margins and outer surface. var. *pubescens.*
    2. Lower surface of leaf-blade completely glabrous; calyx-tube minutely puberulent without; corolla-lobes glabrous or microscopically sparsely puberulent without. var. *coriacea.*

1a. **Pagamea coriacea** Spruce ex Benth. var. **coriacea.**

Type. Prope San Gabriel de Cachoeira ad Rio Negro, Brazil, Jan–Aug 1852, *R. Spruce 2026* (holotype K, isotype F, NY, photo from B at NY).

Distribution. Riverine forest and savanna tree of Amazonas, Brazil, Amazonas, Venezuela of Río Negro-Guainia-Upper Orinoco drainage and Vaupés, Colombia following drainage of Río Vaupés and Apaporis.

1b. **Pagamea coriacea** var. **acuta** Steyermark, var. nov.

A var. *coriacea* differt apice laminarum foliorum acuto, laminis oblongo-ellipticis 13–15 cm longis 3.5–4.5 cm latis.

Type. Yutica, between Mitú and Javareté, Río Vaupés, Vaupés, Colombia, 14 May 1953, *Richard Evans Schultes & Isidoro Cabrera 19367* (holotype US). Paratype. BRITISH GUIANA. Cunuria forest, Membaru-Kurupung trail, at alt. 1000 m, 29 Oct–4 Nov 1951, *Maguire & Fanshawe 32410.*

1c. **Pagamea coriacea** var. **pubescens** Steyermark, var. nov.

A var. *coriacea* differt axillibus nervorum lateralium laminarum foliorum subtus barbatis, lobis calycis plerumque 5 ovatis prominentioribus apice acutis vel apiculatis 0.5–0.7 mm longis 0.5–0.7 mm latis extus minute hispidulo-puberulentibus, tubo calycis 1.5 mm longo extus abundante minuteque hispidulo-puberulenti, corollae tubo extus glabro intus fauce dense villosulo, lobis intus dense villosulis.

Type. Arbor parva; floribus albidis; campina arenosa, Acajutaba, Rio Negro inferiore, Amazonas, Brazil, 22 Mar 1941, *A. Ducke 683* (holotype US, isotype NY). Paratype. VENEZUELA. Savanna shrub along lower Río Sipapo, Rio Cuao, Amazonas, at alt. 100 m, 19 Dec 1948, *Maguire & Politi 27858* (NY).

2. Pagamea plicata Spruce ex Benth. Jour. Linn. Soc. **1**: 109. 1857; Prog. in Martius, Fl. Bras. **6**(1): 286. 1868.

Key to the Varieties of *Pagamea plicata*

1. Leaf-blades with 7–8 pairs of lateral nerves.	var. *plicata.*
1. Leaf-blades with 10 pairs of lateral nerves.	var. *multinervia.*

2a. Pagamea plicata Spruce ex Benth. var. **plicata.**

Type. Prope San Gabriel da Cachoeira, ad Rio Negro, Brazil, Jan–Aug 1852, *R. Spruce 2342* (holotype K, isotype F, photo from B at NY, US).

Distribution. Small or large tree of Amazonas, Brazil and Venezuela, following the drainage of the Rio Negro-Río Guainía-Upper Orinoco. BRAZIL. San Gabriel da Cachoeira, *Spruce 2342.* VENEZUELA. Selva alta hasta donde llega las inundaciones, Maroa, Río Guainía, at alt. 127 m, *Williams 14351;* selva periodicamente anegada, Yavita, at alt. 128 m, *Williams 13962;* dry slope below escarpment, Cerro Yapacana, at alt. 600–800 m, *Maguire, Cowan & Wurdack 30735;* savanna near Base Camp, Cerro Sipapo (Paráque), at alt. 125 m, *Maguire & Politi 28036.*

2b. Pagamea plicata var. **multinervia** Steyermark, var. nov.

A var. *plicata* differt nervis lateralibus utroque latere 10, subtus pilis nervorum lateralium longioribus densioribus 0.8–1 mm longis.

Type. Arbol pequeño, erecto, de selva pluvial de Río Arequi, cerca del ex-pueblo y campo minero, region de Urimán, Estado Bolívar, Venezuela, at alt. 340–380 m, 5 Septiembre 1954, *L. Bernardi 1690* (holotype VEN).

3. Pagamea plicatiformis Steyermark, sp. nov.

Arbor 5-metralis, ramis glabris vel sparse pubescentibus; stipularum vaginis prominentibus 18–20 mm longis dense pilosis pilis adscendentibus vel strigosis apice aristis 4 setulosis hispidis 3.5–6 mm longis munitis, centralibus longissimis; foliis petiolatis, petiolis 12–20 mm longis supra canaliculatis glabratis vel sparse pubescentibus; laminis subcoriaceis ellipticis ad extremitates acuminatis 6.5–14 cm longis 2–4.7 cm latis, supra prominente sulcato-nervatis subtus elevatis, supra glabris vel subglabris, costa media supra glabrata vel sparse pilosa, subtus nervis lateralibus atque costa media pilosis pilis patentibus instructis, superficie inferiori sparse pilosa; nervis lateralibus utroque latere 7–9 valde adscendentibus paullo arcuatis; inflorescentiis 15–40 mm longis, pedunculo 8–23 mm longo tenui 1–2 mm lato ancipitali superne sparse piloso pilis brevibus patentibus instructo; calyce 3 mm longo 4–5-lobato, lobis inaequalibus lanceolatis vel ovatis acutis 1.2–1.5 mm longis 0.75–1 mm latis extus sparse hirtellis intus glabris vel breviter hirtellis; hypanthio 1.5 mm longo extus sparse hispido-piloso intus glabro; corolla 4-lobata, lobis oblongis extus inferne glabra superne pubescenti; staminibus 4 lineari-oblongis, filamentis glabris antheris paullo brevioribus; stylis dense breviter pubescentibus; fructu obovoideo 5–6 mm longo 4 mm lato.

Type. Arbol de 5 m de altura, con fruto globoso, pequeño, verde oscuro; selva de Maroa, Guainía, Alto Río Negro, Amazonas, Venezuela, at alt. 127 m, 9 Feb 1942, *Llewelyn Williams 14190* (holotype F).

This species is related to *P. plicata* Spruce ex Benth., from which it differs in the less coriaceous leaf-blades with longer pubescence, shorter and more slender peduncles, and longer, narrower, and more pointed calyx-lobes. From *P. hirsuta* Spruce ex Benth. it differs in the shorter peduncles and less pubescence on all parts, and from *P. guianensis* Aubl. it may be distinguished by the short peduncle, and pubescent leaves and stipules.

4. **Pagamea velutina** Steyermark, sp. nov.

Arbor ad 12-metralis, ramis florigeris dense hirsutulis; stipularum vaginis 3.5–8 cm longis terminalibus lanceolatis apice obtusis setis nullis vel 4 erectis glabris 0.5 mm longis munitis, dense hirtellis vel hirsutulis; foliis petiolatis, petiolis 15–25 mm longis dense hirsutulis; laminis late elliptico-obovatis vel obovato-ellipticis apice abrupte acuminatis, acumine 5–6 mm longo 3–4 mm lato, basi cuneatim acutis vel acuminatis angustatis, 11–17 cm longis 4.5–7.5 cm latis, supra asperulo-hirtellis costa media hirtella, subtus breviter denseque molliter velutinis, costa media nervis lateralibusque dense pilis patenti-adscendentibus 0.5–0.7 mm longis piloso-hirsutulis; nervis lateralibus utroque latere 7–8 supra parce impressis subtus elevatis; inflorescentia in anthesi 3.5–9 cm longa in fructu 6–10 cm longa, pedunculo in anthesi 1.7–4.5 cm longo in fructu 2.5–5 cm longo complanato 2.5–3 mm lato, rhachidi dense hirtella, ramis inferioribus 4–10 mm longis; floribus 3–5-seriatim praeditis glomerulis inferioribus cum axibus 4–10 mm longis ceteris sessilibus vel cum axibus 2 mm longis; calyce in anthesi 2.5–3.5 mm longo 3–3.25 mm lato in fructu 4–5 mm longo 7–10 mm lato campanulato inaequaliter 4-dentato, dentibus suborbiculari-ovatis vel ovatis ad triangulari-suborbicularibus 0.5–2 mm longis 1–1.5 mm latis, extus dense hirtello intus strigilloso; corolla rotata 5.5 mm longa, tubo 1.5 mm longo basi 1 mm lato extus glabro intus glabro fauce dense villosula excepta, lobis 4 tubo longioribus lanceolato-oblongis apice obtusis vel rotundatis 3.5–4.5 mm longis 1.25–1.8 mm latis extus moderate vel dense pilosulis vel hispidulis intus dense villosulis; antheris 4 oblongis 1.4–1.5 mm longis, filamentis 2.5 mm longis glabris; ovario apice atque apicem versus hispidulo; stylo 0.75–2.5 mm longo glabro, stigmatibus 0.25 mm longis linearibus; fructu subgloboso livido-negro 6–7 mm alto 7–8.5 mm lato glabro.

Type. Tree 12 m high, 12 cm diam; flowers white; occasional near Camp Savanna, Cerro Siparo (Paráque), Amazonas, Venezuela, at alt. 1500 m, 21 Jan 1949, *Bassett Maguire & Louis Politi 28536* (holotype NY). Paratypes. Same locality and date, *Maguire & Politi 28538;* forest above Caño Grande, 1 km northwest of Savanna Camp, Cerro Sipapo, *Maguire & Politi 28016.*

5. **Pagamea hirsuta** Spruce ex Benth. Jour. Linn. Soc. **1**: 111. 1857; Prog. in Martius, Fl. Bras. **6**(1): 287. 1868.

Type. San Carlos on Río Negro, Amazonas, Venezuela, 1853–54, *R. Spruce 3137* (holotype K, isotype P).

Distribution. Shrub or small tree in openings, sandy ground, and savannas following drainage of Río Negro and Río Guainía, Amazonas, Venezuela, and southeastern Colombia in drainage of Río Japurá and Río Vaupés. COLOMBIA. Territorio Caquetá: Río Japurá, mantis cupatí superiore, *A. Ducke 12288* (US). Vaupés: base of Cerro Isibukuri, Río Kananarí, lat. 0° 15′ N, long. 70° 35′ W, *Schultes & Cabrera 15075* (US); bush, caatinga, Rio Negro, vicinity of Piedra de Cocuí, *Schultes & Cabrera 9518.* VENEZUELA. Amazonas: San Carlos on Rio Negro, *Spruce 3137* (holotype); en las malezas y en los claros en la selva de Maroa, Río Guainía, at alt. 127 m, *Williams 14265;* en el bosque, Santa Cruz, margen del Río Atabapo, cerca de la desembocadura del Río Atacavi, *Foldats 3811;* Yavita, at alt. 128 m, *Williams 13920;* scrub savanna 10 km north of Maroa, at alt. 130 m, *Maguire, Wurdack & Keith 41753;* white sand in scrub savanna at Yavita, Río Atabapo, at alt. 130 m, *Maguire 29308.*

6. **Pagamea puberula** Steyermark, sp. nov.

Frutex vel arbuscula, ramulis superne hispidulo-puberulentibus; stipularum vaginis 5.5–6 mm longis dense pulverulentibus vel hispidulo-strigillosis apice 6–8 aristis 1.5–5.5 mm longis inaequalibus dense hispidulo-puberulentibus; foliis petiolatis, petiolis 5–12 mm longis dense hispidulo-puberulentibus vel hirsutulis; laminis ovato- vel lanceolato-ellipticis apice acuminatis vel subacuminatis basi cuneatim subobtusis vel subacutis 5–9 cm longis 1.2–3 cm latis supra papillato-puberulentibus costa media dense hirtello-pilosula excepta, subtus costa media nervis lateralibusque dense minuteque puberulentibus vel dense pilis patentibus ad 0.5 mm longis pilosulis, aliter subtus glabris; nervis lateralibus utroque latere 6–9 supra obsoletis subtus impressis; inflorescentiis 3.5–6 cm longis, pedunculo 1.2–3.5 cm longo dense hispidulo-puberulenti, plerumque simplicibus glomerulos florum 2–3 principales gerentibus, ramis infimis cum axibus 8–9 mm longis; floribus sessilibus; calyce profunde campanulato 2.2–2.5 mm longo apice 2–3 mm lato extus sparse vel moderate puberulo ad glabro, hypanthio extus sparse hispidulo-puberulenti intus sparse vel moderate strigilloso, inaequaliter 4–5-lobato, lobis late ovatis vel suborbiculari-ovatis vel ovato-oblongis apice obtusis vel rotundatis ad subacutis 0.5–1.3 mm longis 0.5–1 mm latis; corolla rotata 4.2–4.5 mm longa, tubo 1–1.5 mm longo fauce intus dense villosa aliter glabra, lobis 4–5 oblanceolatis apice obtusis inflexis cucullatis 2.5–3 mm longis 0.8–1.3 mm latis extus glabris vel medio basin versus minute puberulentibus intus dense villosulis; staminibus 4–5, antheris 0.8–1.3 mm longis, filamentis 0.5–0.7 mm longis glabris; ovario dense hispidulo-puberulo vel apice solum minute sparseque puberulenti vel moderate pilosulo.

Type. Frutex parvus; floribus albis; in sabulosis Campos do Chicodacá, Pará, Brazil, 21 Aug 1907, *A. Ducke 8462* [Herb. RB 22951] (holotype US, paratype of *Pagamea guianensis* var. *pilosa* Standl.). Paratypes. In vicinibus Barra, Prov. Rio Negro, Brazil, 1850–51, *Spruce s.n.* (NY); silva paludosa non inundabili, loco Cachoeira do Mindú, Manáos, Amazonas, Brazil, *Ducke 137* (NY, US).

The *Ducke 8462* specimen was cited by Standley (Field Mus. Bot. Ser. **17**: 279. 1937) in his *Pagamea guianensis* var. *pilosa.* The *Spruce* collection was cited by Martius under *P. guianensis.*

7. **Pagamea pilosa** (Standley) Steyermark, stat. nov.

Pagamea guianensis Aubl. var. *pilosa* Standl., Field Mus. Bot. Ser. **17**: 279. 1937, type: on campinarana alta, basin of Rio Madeira, Municipality Humayta, on plateau between Rio Livramento and Rio Ipixuna, 7–18 Nov 1934, *B. A. Krukoff 7083* (holotype F).

Arbor 15-metralis, ramis terminalibus dense puberulentibus; stipularum vaginis 7–13 mm longis dense strigilloso- vel hispidulo-puberulentibus apice saltem 8 aristis 2–4 mm longis dense hispidulo-puberulentibus instructis; foliis petiolatis, petiolis 5–15 mm longis moderate puberulis; laminis oblanceolatis vel elliptico-oblanceolatis apice acutis vel subacuminatis basi cuneatim subacutis vel acutis 7–8.5 cm longis 2.3–3 cm latis supra glabris costa media dense pilosula excepta, subtus dense minute adpresso-pilosulis costa media nervis lateralibusque dense

pilosulis; nervis lateralibus utroque latere 4–5; inflorescentia (immatura) 2–3.5 cm longa glomerulos florum 2–3 principales gerentibus, ramis infimis sessilibus vel cum axibus 1–2 mm longis, rhachidi ramisque dense pilosulis, pedunculo 12–17 mm longo dense pilosulo; calyce 2–2.5 mm longo 1.5 mm lato extus sparse hirtellis pilis patentibus 0.1–0.25 mm longis munitis, inaequaliter 4-lobato, lobis ovatis vel late oblongis ad suborbiculari-ovatis apice obtusis vel rotundatis; corolla (immatura) rotata 2 mm longa, tubo glabro, lobis extus sparse strigosis vel hispidulis intus dense villosulis; ovario glabro; stylo glabro.

8. **Pagamea anisophylla** Standl. & Steyerm. Fieldiana Bot. **28**: 584. *fig. 128.* 1953.

Type. Vicinity of Sanariapo, near Río Sanariapo, Amazonas, Venezuela, 8 Sep 1944, ***Julian A. Steyermark 58461*** (holotype F).

Distribution. Amazonas, Venezuela. Vicinity of Sanariapo, *Steyermark 58461* (holotype); Cerro Moriche, at alt. 300–800 m, *Maguire, Cowan & Wurdack 30873;* Serrania Yutaje, Río Manapiare, frequent at edges of savanna 1 km east of Base Camp, *Maguire & Maguire 35042.*

The subtruncate or remotely repand-denticulate summit of the calyx is characteristic of this species. In the holotype the lower surface of the leaves is completely glabrous, but in the specimen of *Maguire, Cowan & Wurdack 30873* barbate hairs are present in some of the axils of the lateral nerves on the lower side of the leaf-blade.

9. **Pagamea thyrsiflora** Spruce ex Benth. Jour. Linn. Soc. **1**: 110. 1857; Prog. in Martius, Fl. Bras. **6**(1): 286. *pl. 81, f. 1.* 1868.

Type. In humid forest prope San Carlos del Río Negro, Amazonas, Venezuela, 1853, *R. Spruce 2957* (holotype K, isotype NY).

Distribution. Shrub or small tree to 5 m, ascending to 1600 m on sandstone plateaus and table mountains, British Guiana and southern Venezuela south to Amazonas and Pará, Brazil, and west to Vaupés, Colombia. BRITISH GUIANA. Kaieteur Plateau, *Maguire & Fanshawe 23155;* Partang River, Merume Mountains, Upper Mazaruni River Basin, *Maguire & S. S. & C. L. Tillett 43874;* Kamarang River-Wenamu Trail, Samwarakna Creek, *Maguire & Fanshawe 32567.* BRAZIL. Serra Tunuhy, Foz do Cáiary, Içana, Amazonas, *Froes 21371;* arenosis Campo Grande, Porto de Mox (ad flumen Xingú inferiore), Pará, *Ducke 18835.* COLOMBIA. Río Kuduyarí (tributary of Río Vaupés), quartzite savanna, Yapobodá, Vaupés, *Schultes & Cabrera 20015;* savanna at Cacagual, Río Atabapo, *Maguire, Wurdack & Keith 41450.* VENEZUELA. Amazonas: prope San Carlos, *Spruce 2957* (holotype); canal de Cassiquiare, *Froes 21510;* Cerro Moriche, *Maguire, Cowan & Wurdack 30861, 30953;* west base of Cerro Parú, *Cowan & Wurdack 31482;* Río Cuao, Río Sipapo, *Maguire & Politi 27855;* north escarpment above Culebra, Cerro Duida, *Maguire, Cowan & Wurdack 29588, 29590, 29627;* top of Cerro Cariche, *Wurdack & Adderley 43660.* Bolívar: Sierra Auraima, *Steyermark 90836;* Sierra de Lema, headwaters of Río Chicanán, *Steyermark 89630;* mesa between Ptari-tepuí and Sororopán-tepuí, *Steyermark 60264;* Cerro de las Guacamayas, Río Avequi, *Bernardi 1667;* Cerro Arepuchi, Río Caroní, *Cardona 1212.*

The flowers of this species are usually tetramerous, but may also be pentamerous. There is variation in the pubescence on the outer surface of the calyx, and in the shape and width of the leaf-blades. In general, the calyx and corolla are of smaller dimensions than in *P. guianensis* Aubl., and the flowers are arranged in open branched inflorescences.

10. **Pagamea macrophylla** Spruce ex Benth. Jour. Linn. Soc. **1**: 110. 1857; Prog. in Martius, Fl. Bras. **6**(1): 287. 1868.

Type. Prope Panuré ad Rio Vaupés, Brazil, Oct 1852–Jan 1853, *R. Spruce 2578* (holotype K, isotype fragment F, photo of holotype from B at F, NY).

Distribution. Drainage of Rio Uaupés and Solimoes, Amazonas, Brazil. Mata Caatingada, São Paulo do Olivença, *Froes 20724;* prope Panuré ad Rio Vaupes, *Spruce 2578* (holotype).

This species simulates large-fruited varieties of *P. guianensis* Aubl., but the fruiting calyx is much deeper, the ovary is pilosulous at the summit, and the petioles are much longer.

11. **Pagamea duckei** Standley, Field Mus. Bot. Ser. **17**: 278. 1937.

Type. Tarumá-miry, campina cerrada, terra firme, Amazonas, Brazil, 22 Dec 1912, *A. Ducke 12415* (holotype MG, fragment in F).

Distribution. Known only from Amazonian Brazil. In addition to the type specimen, the following are referable to this species: Campina arenosa, Rio Tarumá-miry, Manáos, *Ducke 1166, 696.*

12. **Pagamea guianensis** Aublet, Pl. Guian. **1**: 113. *pl. 44.* 1775.

Key to the Varieties of *Pagamea guianensis*

1. Fruit 5–7 mm long, 5–7 mm broad; fruiting calyx 4.5–6 mm broad. var. *guianensis.*
1. Fruit 10–15 mm long, 8–10 mm broad; fruiting calyx 6–7 mm broad. var. *macrocarpa.*

12a. **Pagamea guianensis** Aubl. var. **guianensis.** Fig. 36, M–O.

P. guianensis var. *typica* Standl., Field Mus. Bot. Ser. **17**: 279. 1937.

P. guianensis var. *parviflora* Spruce ex Prog., Mart. Fl. Bras. **6**(1): 285. 1868, type: prope San Gabriel do Cachoeira, ad Rio Negro, Brazil, Aug 1852, *R. Spruce 2260* (isotype NY).

Type. Prope & supra montem Serpent, & a l' habitation appellée Gallion, French Guiana, *Aublet* (photo of holotype from BM at NY).

Distribution. Shrub or small tree of savannas and scrub forest, often on sandy soils, Guianas, Amazonas, Venezuela, and Amazonian Brazil.

12b. **Pagamea guianensis** var. **macrocarpa** Steyermark, var. nov.

A var. *guianensis* differt calycibus fructuum majoribus 6–7 mm latis atque fructibus 10–15 mm longis 8–10 mm latis.

Type. Tree 15 m; wet tropical forest of Amazon basin, on Río Caquetá, below mouth of Río Orteguaza, Solano, 8 km SE of Tres Esquinas, Comisario de Caquetá, Colombia, at alt. 200 m, 4 Mar 1945, *Elbert L. and Ruby R. Little, Jr. 9533* (holotype NY, isotype US).

The localities cited by Aublet in the original description of *P. guianensis* are just south of Cayenne in lowland forest. Aublet's plate shows a simple unbranched inflorescence with 2–3 tiers of few-flowered sessile clusters of flowers. Collections examined by the author from French Guiana are those of *Melinon 307* (US) and *Melinon 337* (NY), both from Maroni river, in the lowlands. The

NY sheet shows a stipule 13–14 mm long with a glabrous tubular sheath beset with glabrous setae 3–3.5 mm long, whereas the US sheet has the sheaths of the stipules minutely puberulent.

Suriname material (arbor no. 726, Herb. no. 2610 in NY and US) matching Aublet's plate shows simple unbranched inflorescences with 3–4 sessile, few-flowered clusters with puberulent inflorescences and peduncle, leaf-blades 5.5–8.5 cm long by 1.5–2.5 cm wide, and the axils of the midrib and lateral nerves barbate on the lower leaf surface. Although the style is described in the original description as "minutely" pubescent, an examination of the holotype specimen shows that it is glabrous.

13. **Pagamea montana** Gleason & Standley, Field Mus. Bot. Ser. **7**: 421. 1931.

Type. Dry ridge tops, Savanna Hills, Cerro Duida, Amazonas, Venezuela, at alt. 1340 m, Aug 1928–Apr 1929, *G. H. H. Tate 803* (holotype NY).

Distribution. Shrub or small tree, endemic to sandstone table mountains of Territorio Federal Amazonas, southwestern Venezuela, at alt. 1250–2100 m. Cerro Duida, *Tate 803* (holotype); Cerro Sipapo (Paráque), *Maguire & Politi 28585, 28586, 28589, 28632;* Cerro Guanay, *Maguire, K. D. Phelps, C. B. Hitchcock & G. Budowski 31682;* Caño Yutaje, Serrania Yutaje, *Maguire & Maguire 35198;* Cerro Coro-Coro, Serrania Yutaje, *Maguire & Maguire 35433;* Cerro de la Neblina, *Maguire, Wurdack & Bunting 37341.*

The differences between this species and the related *P. guianensis* are brought out in the key to the species.

14. **Pagamea capitata** Benth. Jour. Linn. Soc. **1**: 85, 109. 1857.

Key to the Subspecies and Forms of *Pagamea capitata*

1. Setae of stipular sheath 3–5.5 mm long, densely short hispidulous throughout; petiole 2–6 mm long. subsp. *conferta* f. *conferta.*
1. Setae of stipular sheath 1–2.25 mm long, glabrous, often resinous-coated; petiole 4–15 mm long.
    2. Anthers included or scarcely exserted, subsessile, 0.4–0.7 mm long; filaments 0.2–0.4 mm long; hairs on midrib of lower leaf surface conspicuously abundant and long-spreading, mainly 0.4–0.6 mm long; lateral nerves on lower leaf surface moderately to densely pilosulous. subsp. *thibaudiaefolia.*
    2. Anthers chiefly exserted, 0.8–1.2 mm long; filaments manifest, 1–1.5 mm long; hairs on midrib of lower leaf surface sparsely to moderately abundant and shorter, averaging 0.3 mm or less long, sometimes absent or nearly so; lateral nerves on lower leaf surface glabrous or sparsely puberulent.
        3. Calyx-lobes shorter than calyx-tube, ovate to triangular, 2 mm long, 1.75–2 mm wide; corolla 4–5-lobed; anthers 4–5. subsp. *conferta* f. *breviloba.*
        3. Calyx-lobes longer than calyx-tube, linear or linear-lanceolate to broadly lanceolate, 1.5–2.75 mm long, 0.5–1.5 mm wide; corolla 4-lobed; anthers 4.
            4. Leaf-blades 1.2–2 cm broad, 3-3/4–4-1/2 times longer than broad, narrowly lance-elliptic to elliptic-lanceolate, not noticeably broadest in middle; leaves cuneately narrowed to an acute to subacuminate base. subsp. *caudata.*
            4. Leaf-blades 1.5–3 cm broad, 2-1/4–3 times longer than broad, ovate to elliptic-ovate or broadly ovate-lanceolate, noticeably broadest in middle; leaves mainly subobtuse or somewhat rounded at base, not cuneately tapering. subsp. *capitata.*

14a. **Pagamea capitata** Benth. subsp. **capitata,** emendavit Steyermark.

Type. Roraima, Venezuela, 1842–43, *Robert Schomburgk 578* (holotype K, isotype NY). Lobi corollae intus pubescentes.

Distribution. Shrub of upland sandy savannas and scrub forest at alt. 560–1220 m, Suriname (Tafelberg), British Guiana, and southeastern Venezuela in Estado Bolívar. SURINAME. Tafelberg, *Maguire 24252, 24740.* BRITISH GUIANA. Kaieteur Savanna, Potaro River, *Jenman 867* (K, paratype of *Cephaelis thibaudiaefolia*)*;* Kaieteur Plateau, *Maguire & Fanshawe 23185, 23281;* Arabaru River (Kako tributary), upper Mazaruni drainage, *Pinkus 189;* Samwarakna-tipu (Holi-tipu), *Maguire & Fanshawe 32534.* VENEZUELA. Roraima, *Rob. Schomburgk 578* (holotype of *Pagamea capitata*)*;* northeast of Luepa, vicinity of km 150 in valley of savanna of Río Uarama, *Steyermark & Aristeguieta 62;* Santa Teresita de Kavanayen northwest to Río Karuai, *Steyermark 59339;* southwestern base of Ptari-tepui, between Río Karuai and Salto de Iraba-naima, *Steyermark 60700;* Uaudapai, Kavanayen, *Lasser 1782;* northeast of Luepa, vicinity of km 150 in valley of savanna of Río Uarama, *Steyermark & Nilsson 630;* teraza de Guayaraca, Auyán-tepuí, *Vareschi & Foldats 4637;* Mount Auyán-tepuí, *Tate 1164.*

Although Bentham described the corolla-lobes as ''intus fere glabri,'' an examination of an isotype specimen (*Schomburgk 578*) shows the interior of the corolla-lobes to be densely puberulent. In all other respects his description applies to the characters evident on the isotype. The lower surface of the leaves of the type collection have moderately to densely pilose midrib and lateral nerves, and the lower surface itself, while mostly glabrous, may have a scattering of pilosulity. The axils of the lateral nerves at their junction with the midrib on the lower surface are rather noticeably barbate in the type collection. This barbate condition varies, as it is not present in the *Maguire-Fanshawe 23185* collection, but is obvious in the *Steyermark 59339* collection and other collections cited.

14b. Pagamea capitata Benth. subsp. **caudata** (Huber) Steyermark, stat. nov.

P. caudata Huber, in Bull. Soc. Bot. Geneve 1915, ser. 2, 6: 211. *fig. 17.* 9 Nov 1914.

Type. In fruticetis campina rana dictis ad flumen Ariramba superiore, Pará, Brazil, 20 Decembre 1906, *A. Ducke 8026b* (holotype MG, fragment of holotype at F).

Distribution. Known only from the type locality. Another collection, *Ducke 11269,* from flumen Jaramacarú affluente flumen Ariramba subaffluente flumen Trombetas, is a topotype and is deposited at US.

Although Huber describes the setae at the apex of the stipular sheath as 2–3 mm long, a photograph of the type specimen at F shows the setae as short as 1.5 mm.

14c. Pagamea capitata Benth. subsp. **thibaudiaefolia** (Wernh.) Steyermark, stat. nov.

Cephaelis thibaudiaefolia Wernham, Jour. Bot. 52: 313. Dec 1914.

Type. Suriname, *Hostmann 801* (lectotype K).

Distribution. White sand savannas and scrub forest at low elevations above sea level, Suriname and British Guiana. SURINAME. *Hostmann 801* (lectotype of *Cephaelis thibaudiaefolia*)*;* Jodensavanna, near ruin, *Lanjouw & Lindeman 2979.* BRITISH GUIANA. Warum-Ituni, along the Berbice-Rupununi Cattle trail, *Abraham 126;* 3 miles E of Atkinson Field, *Irwin 395;* savannas, E of

Ituni, 35 miles S of Mackenzie, *Cowan 39253;* Upper Mazaruni River, Long. about 60° 10′ W, *De La Cruz 2214;* Kamakusa, Upper Mazaruni River, Long. about 59° 50′ W, *De La Cruz 2862;* Malali, Demerara River, Lat. about 5° 35′ N, *De La Cruz 2659;* Atkinson Field, *Harrison 1737.*

An examination of the two specimens (*Hostmann 801* and *Jenman 867*) upon which Wernham based his description of *Cephaelis thibaudiaefolia,* examined through the kind courtesy extended by the Director of Kew Herbarium, reveal that actually two taxa are represented as variations of the *Pagamea capitata* complex.

The *Hostmann 801,* selected as the lectotype in the present treatment, represents the part of the description by Wernham pertaining to leaf-blades "lanceolatis" and "basi brevissime acuminatis"; it represents the variation encountered on the "muri" sands and scrub growth of lowland altitudes in British Guiana and Suriname [i.e., *P. capitata* subsp. *thibaudiaefola*]. On the other hand, the *Jenman 867* specimen from Potaro River, Kaieteur Savannah, represents that part of the description by Wernham pertaining to leaf-blades "ovatis" and "basi subrotundatis" and represents Bentham's typical *Pagamea capitata* [subsp. *capitata*] of the savannas of the higher altitudes (Tafelberg of Surinam, Kaieteur Plateau of British Guiana, and Gran Sabana, Venezuela).

14d. Pagamea capitata Benth. subsp. **conferta** (Standl.) Steyermark, stat. nov.

P. conferta Standl. in Field Mus. Bot. Ser. 7: 419. 1931.

Type. Dry rocky slopes of Savanna Hills, summit of Mount Duida, Amazonas, Venezuela, at alt. 1340 m, Aug 1928–Apr 1929, *G. H. H. Tate 794* (holotype NY).

Distribution. Known only from Cerro Duida, Amazonas, Venezuela. Besides the type collection, *Steyermark 58192,* a topotype, is to be referred to this taxon.

14d′. Pagamea capitata Benth. subsp. **conferta** f. **breviloba** Steyermark, f. nov.

A subsp. *conferta* f. *conferta* differt calycis lobis ovatis vel triangulari-ovatis brevioribus 0.5–1.5 mm longis 0.5–0.7 mm latis.

Type. Shrub 3 m; along north escarpment above Culebra, Río Cunucunuma, Cerro Duida, Amazonas, Venezuela, at alt. 1400 m, 20 Nov 1950, *Bassett Maguire, R. Cowan & J. Wurdack 29573* (holotype NY). Paratypes. VENEZUELA. Culebra Peak, Cerro Duida, 22–24 Apr 1949, *Maguire & Maguire, Jr. 29125;* Sierra Ichún, Estado Bolívar, *Steyermark 90281.*

15. Pagamea diceras Steyermark, sp. nov. Fig. 30, A–D.

Arbuscula 4-metralis; stipularum vaginis 5–9 mm longis glabris apice eroso-paleaceis 8 setis glabris inaequalibus 0.5–2.5 mm longis; foliis petiolatis, petiolis 2–4 mm longis glabris; laminis oblanceolatis vel oblongo-oblanceolatis ad elliptico-obovatis subrevolutis apice obtusis vel subacutis basi cuneatim subacutis vel acutis 2.6–5 cm longis 1.5–2 cm latis, utrinque glabris; nervis lateralibus utroque latere 5–6 fere obsoletis; inflorescentiis subspicatis 12–18 mm longis 9–15 mm latis cum pedunculo 2.5–5 cm longis, pedunculo 1.5–4 cm longo apicem versus ampliato complanatoque ad 3–4 mm lato, infra medium 1.5–2 mm lato, ancipitali glabro; floribus sessilibus per duo latera rhachidis instructis; calyce campanulato 3 mm longo apice 3 mm lato utrinque glabro marginibus ciliolatis exceptis inaequaliter 4–5 lobato, lobis triangulari-ovatis acutis 1 mm longis 1–1.25 mm latis; corolla subcampanulato-subrotata 5–5.5 mm longa, tubo 2 mm longo basi

2 mm lato fauce 3–3.5 mm lato, fauce intus dense villosa, aliter glabro, lobis oblongo-lanceolatis obtusis cum appendice cucullata inflexa 3.25–4 mm longis 1.5 mm latis extus glabris intus dense albido-lanulosis; staminibus 5, antheris 1.75 mm longis breviter exsertis, filamentis 1 mm longis glabris; ovario glabro, stylo 3.25 mm longo glabro; stigmatibus 1 mm longis linearibus apice truncato-rotundatis; fructu subgloboso, 4–5 mm longo, 4–5 mm lato.

Type. Bushy tree 4 m; frequent in cumbre along west rim 1–6 km north of camp caño head, Serrania Parú, Amazonas, Venezuela, at alt. 2000 m, 4 Feb 1951, *R. S. Cowan & John J. Wurdack 31241* (holotype NY). Paratype. Same locality, 31 Jan 1951, *Cowan & Wurdack 31088.*

This species is characterized by the flattened upwardly broadened rachis of the inflorescence, the flowers unilaterally subspicate, sessile, arranged in two series along the rachis, the pentamerous flowers with ciliolate calyx-margins, glabrous peduncle, and glabrous obsoletely-nerved leaf-blades.

16. **Pagamea standleyana** Steyermark, Fieldiana Bot. **28**: 589. *fig. 130.* 1953, emendavit Steyermark.

Lobi corollae oblongi intus dense breviter villosi.

Type. Scrubby forest on rocky open portion of plateau on southeast-facing slopes, Ptari-tepui, Estado Bolívar, Venezuela, at alt. 1600 m, 1 Nov 1944, *Julian A. Steyermark 59634* (holotype F).

Distribution. Sandstone table mountains, at alt. 1200–2200 m, Estado Bolívar, Venezuela. Ptari-tepuí, *Steyermark 59634* (holotype); Uei-tepuí, between Luepa and Cerro Venamo, at alt. 1300 m, *Steyermark & Nilsson 323;* Sarven-tepuí, Chimantá Massif, at alt. 1750 m, *Wurdack 34149;* at Auyán-tepuí, at alt. 2200 m, *Cardona 2729;* Cerro Venamo, at alt. 1575 m, *Steyermark, G. C. T. & E. Dunsterville 92564.*

As originally described, the corolla-lobes were stated to be ovate and were so drawn. Actually, a re-examination of other corollas reveals that they are oblong. Also, in the figure depicting the interior of the corolla-lobes the pubescence is indicated as of a short-papillate type, whereas the pubescence actually consists of elongate hairs of dense villose indument. They are not as long and dense as in *P. montana* and some other species.

The first sheet of the holotype at F (no. 1181991) is a mixture: the fruiting specimen on the left hand side of the sheet is *P. pauciflora* without barbate axils of the nerves of the lower leaf surface, but showing a puberulent lower midrib, whereas the flowering specimen on the right hand side of the sheet is *P. standleyana* showing barbate axils and puberulent midrib of the lower leaf surface.

17. **Pagamea duidana** Standl. & Steyerm. Fieldiana Bot. **28**: 586. 1953, emendavit Steyermark.

Costa media laminarum foliorum subtus plerumque puberulens.

Type. Slopes at Central Camp, summit of Mount Duida, Amazonas, Venezuela, at alt. 1600 m, 28 Dec 1928–1 Jan 1929, *G. H. H. Tate 567* (holotype NY).

Distribution. Sandstone table mountains (Cerro Duida and Cerro de la Neblina), Territorio Federal Amazonas, Venezuela, at alt. 1450–1675 m. Besides the holotype collection, the following collections belong here: Along valley forest between Central Camp and Brocchinia Hills, summit of Cerro Duida, *Steyermark 58116;* summit of Cerro de la Neblina, *Maguire, Wurdack & Bunting 37339.*

This species resembles *P. montana*, but has a longer, more infundibuliform corolla-tube, relatively sparsely villosulous inner surface of the corolla-lobes with a glabrate part towards the apex, and barbate axils of the lower leaf surface.

18. **Pagamea pauciflora** Standl. & Steyerm. Fieldiana Bot. **28**: 588. 1953, emendavit Steyermark.

Flores solitarii vel subsolitarii ad quinque.

Type. Summit of Carrao-tepuí, estado Bolívar, at alt. 2470–2500 m, 7 Dec 1944, *Julian A. Steyermark 60888* (holotype F).

Distribution. Shrub on sandstone table mountains (Carrao-tepuí, Ptari-tepuí, and Chimantá Massif), Estado Bolívar, southeastern Venezuela, at alt. 2000–2500 m. In addition to the type collection, the following specimens belong here: Bonnetia roraimae forest, Ptari-tepuí, *Steyermark 59769* (paratype); summit, at edge of escarpment, Torono-tepuí, Chimantá Massif, *Steyermark & Wurdack 664;* lower cumbre, northwest cumbres, Churi-tepuí (Muru-tepuí), Chimantá Massif, *Wurdack 34183*.

19. **Pagamea brevipedunculata** Steyermark, sp. nov.

Arbuscula 3–6-metralis, ramis terminalibus vel juvenilibus minute puberulentibus; stipularum vaginis 3 mm longis dense scabridulo-puberulentibus apice setis 2 mm longis glabris resinosis instructis; foliis petiolatis, petiolis 2–3 mm longis dense minutissimeque scabro-puberulentibus; laminis ovatis vel elliptico-ovatis ad elliptico-lanceolatis apice subacuminatis vel acuminatis basi obtusis vel rotundatis 3–4 cm longis 1–2 cm latis decurrentibus cum petiolis, supra minutissime scabridulo-puberulentibus, subtus costa media minutissime hispidulo-puberulenti aliter ut videtur glabriusculis; nervis lateralibus utroque latere 4–5; inflorescentia 6–10 mm longa, pedunculo nullo vel usque ad 6 mm longum minutissime sparseque puberulenti vel glabrato; calyce campanulato-turbinato 3.8–4.5 mm longo, tubo 1.8–2 mm longo 1.5–1.7 mm lato extus sparse breviter hirtello, lobis 4 inaequalibus lineari-lanceolatis vel lanceolatis acutiusculis vel subacutis 2–2.5 mm longis 0.7–0.9 mm latis extus moderate breviter hirtellis; corolla subrotata 4 mm longa, tubo 2.2 mm longo 1.5 mm lato extus glabro intus fauce dense barbata aliter minutissime papillato basi ipsa glabra excepta, lobis 4 late ovato-oblongis vel lanceolato-oblongis apice obtusis vel rotundatis 2 mm longis 1.2 mm latis extus breviter sparse hirtellis intus dense pilosulo-villosulis; staminibus 4, antheris oblongis 0.7 mm longis, filamentis 0.7 mm longis glabris ad faucem insertis; ovario omnino glabro; stylo 2.75 mm longo glabro; fructu globoso 4.5 mm longo 4.5 mm lato glabro.

Type. Bushy tree 3–6 m high; frequent in high bush savanna, North Valley, Cerro Guaiquinima, Estado Bolívar, Venezuela, at alt. 1600–1700 m, 10–12 Jan 1952, *Bassett Maguire 33070* (holotype NY). Paratype. Same locality, 4 Jan 1952, *Maguire 32982*.

This species is related to *P. capitata* Benth., from which it differs in the glabrous ovary, smaller nearly glabrate leaves, and shorter petioles.

20. **Pagamea reducta** Steyermark, sp. nov.

Arbuscula 4-metralis, ramis terminalibus vel juvenilibus dense puberulentibus; stipularum vaginis 2.5–3.5 mm longis minutissime denseque pulverulentibus vel puberulentibus apice hispidulo-ciliolatis 8 dentibus 0.5–0.75 mm longis hispi-

dulo-puberulentibus cacumine glabro excepto instructis; foliis petiolatis, petiolis 3–4 mm longis dense puberulentibus vel hispidulo-puberulentibus; laminis ovatis vel ovato- vel oblongo-ellipticis apice subiter acutis vel acutis basi acutis vel acutiusculis 1–2.5 cm longis 0.5–1.2 cm latis, supra glabris, subtus costa media minute puberulenti-pulverulenti atque axillis nervorum lateralium 2–3 barbatis ceterum glabris; nervis lateralibus obsoletis vel nullis; inflorescentia 8–13 mm longo subcapitata 2–5-flora, pedunculo 2–9 mm longo ca. 1.5 mm lata ancipitali complanato superficie dense puberulenti angulis magis hispidulo-puberulis; calyce subturbinato 3–4 mm longo apice 3 mm lato basi 1.5 mm lato extus sparse puberulenti prope basin magis moderate puberulenti intus glabro infra medium costato, lobis 4 inaequalibus irregularibus triangulari-ovatis obtusis vel rotundatis 1–2 mm longis 0.75–1.5 mm latis marginibus costatisque ciliolatis; corolla rotato-subcampanulata vel subrotata 5.25–5.5 mm longa, tubo 1.5–2 mm longo basi 1.5 mm lato extus glabro intus fauce villosa ceterum glabro, lobis 4 ovato-oblongis obtusis apice cum appendice cucullato-inflexa 3.5–4 mm longis 1.5–2.1 mm latis extus glabris intus infra medium dense villosulis apicem versus glabratis vel sparse puberulis vel papillato-puberulentibus; antheris late oblongis 1.5 mm longis, filamentis 2 mm longis glabris; stylo 2.5–3 mm longo.

Type. Tree 4 m; common in cumbre, Uaipan-tepui, Estado Bolívar, Venezuela, at alt. 1900 m, 1–15 Feb 1948, *Kathleen D. Phelps & Charles B. Hitchcock 366* (holotype NY, isotype VEN). Paratype. Cumbre del Cerro Uaipán, at alt. 1940 m, 26 Nov 1946, *Cardona 2072, 2071* (VEN).

This species is noteworthy for having the upper one-third to one-half of the inner surface of the corolla-lobes glabrous, glabrate, or only partly pubescent down the center in contrast to the lower half, which is densely villosulous. Additional distinguishing characters of this taxon are the short, few-flowered peduncles, the very small leaf-blades with only 2–3 tufts of barbate hairs in the axils of the lower leaf-surface, and the obsolete lateral nerves.

21. **Pagamea uniflora** Steyermark, sp. nov.

Frutex 3–4-metralis, ramis terminalibus vel juvenilibus minute denseque puberulentibus; stipularum vaginis 3.5 mm longis minute puberulentibus apice 4–8 dentibus inaequalibus lateralibus brevioribus 0.5–1.5 mm longis inferne pubescentibus instructis; foliis petiolatis, petiolis 3–4.5 mm longis utrinque minute puberulentibus; laminis oblanceolatis vel oblanceolato-ellipticis revolutis apice acutis vel acutate obtusis 1.5–2.5 cm longis 0.5–1 cm latis, supra glabris costa media sulcata, subtus costa media minute puberulenti atque axillis nervorum lateralium plerumque 2 barbatis ceterum glabris, marginibus dense hispidulo-ciliolatis; nervis lateralibus obsoletis vel nullis; inflorescentia uniflora, pedunculo in anthesi 3–4 mm longo in fructu 5–8 mm longo minute hispidulo-pulverulenti; floris bractea ovata carinata 1 mm longa ciliolata; calyce turbinato-subcylindrico 4–5 mm longo apice 3 mm lato basi 1 mm lato inferne carinato extus glabro, lobis 4 inaequalibus ovatis vel ovato-lanceolatis subacutis vel acutate obtusis 0.5–2.25 mm longis 0.5–1 mm latis intus glabris marginibus ciliolatis; corolla breviter hypocrateriformi vel subrotata 5.75 mm longa, tubo 2.25 mm longo basi 1.5 mm lato fauce 2 mm lato, extus glabro intus fauce villosulo ceterum glabro, lobis 4 anguste lineari-oblongis apice obtusis cum appendice supra medium leviter puberulis; antheris 4 paullo exsertis 0.7–0.8 mm longis, filamentis 0.5 mm longis glabris; ovario glabro; stylo 3 mm longo glabro, stigmatibus rhomboideo-obovoideis apice rotundatis 0.75 mm longis; fructu obovoideo rubro 7–8 mm longo 4–5 mm lato.

Type. Shrub 3–4 m tall; corolla white; leaves erect, coriaceous, deep green and shining above, pale green below; *Bonnetia* forest, northwestern part of summit of Abacapá-tepui, Chimantá Massif, Estado Bolívar, Venezuela, at alt. 2125–2300 m, 13 Apr 1953, *Julian A. Steyermark 74877*.

This species is noteworthy for its solitary corolla, corolla-tube longer than in most of the species of its alliance, and the two tufts of axillary hairs along the midrib of the lower leaf surface.

22. Pagamea magniflora Steyermark, sp. nov.

Frutex 2–3-metralis; stipularum vaginis 9–10 mm longis glabris apice eroso-setulosis 8 dentibus inaequalibus 0.5–1 mm longis sparse puberulentibus vel glabratis instructis; foliis petiolatis, petiolis 5–8 mm longis marginibus minute hispidulo-puberulentibus aliter glabris; laminis oblongo-ellipticis vel ellipticis apice acutis vel subacuminatis basi acutis vel acuminatis cuneatim angustatis 2–3.2 cm longis 0.8–1.4 cm latis revolutis utrinque glabris, marginibus minute ciliolatis; inflorescentia 1–3-flora 2.4–2.7 cm longa, pedunculo 11–13 mm longo 1–1.5 mm lato axillari 2–3-costato saepe ancipitali complanatoque glabrato vel dense puberulenti; inflorescentiae bracteis simplicibus ovatis acuminatis 3 mm longis glabris; calyce turbinato costato basi sensim cuneato 5.5–8 mm longo apice 4.5–6 mm lato basi 1.5 mm lato utrinque glabro, lobis 3–5 irregularibus depresso-deltoideo-suborbicularibus vel ovatis apice deltoideis vel obtuse subulatis 0.5–1.75 mm longis 1–2 mm latis, acumine ad 1 mm longo; corolla tubuloso-cylindrica 8–10 mm longa, tubo 7–8 mm longo basi 2 mm lato fauce 2.5 mm lato extus parte basilari 4.5 mm glabro superne sparse puberulo, intus fauce hirsutula ceterum glabro, lobis 4 late oblongo-lanceolatis vel lanceolato-oblongis obtusis cum appendice cucullato-inflexa 2.5–3 mm longis 1.5 mm latis extus glabris basin versus sparse puberulis exceptis intus dense villosulis; antheris 4 paullo exsertis 1.1 mm longis, filamentis 0.75–1 mm longis glabris; ovario glabro; stylo glabro.

Type. Shrub 2–3 m high; occasional in thick low bush of upper cumbre slopes between North Peak and Central Plateau, Ilu-tepuí, Estado Bolívar, Venezuela, at 2450–2550 m, 15 May 1952, *Bassett Maguire 33427* (holotype NY).

This species is unusual in having an elongate tubular corolla, which is much longer than in any of the other species to which it is related. In addition to this character, the 2–3-flowered inflorescences and glabrous leaves further distinguish it. It is habitally similar to *P. pauciflora* Standl. & Steyerm. in its small leaf-blades with non-barbate axils on their lower surface and few-flowered inflorescence, but strikingly different in the large size and shape of the corolla.

23. Pagamea sessiliflora Spruce ex Benth. Jour. Linn. Soc. **1**: 110. 1857; Prog. in Martius, Fl. Bras. **6**(1): 285. 1868.

Type. Prope San Carlos del Río Negro, Amazonas, Venezuela, Mar–Apr 1853, *R. Spruce 3045* (holotype K, isotype F, NY).

Distribution. Shrub or small tree of the Rio Negro drainage, Territorio Federal Amazonas, Venezuela, at alt. 100–150 m. In addition to the type collection, the following specimens may be cited: San Carlos, *Williams 14544, 14547, 14649;* Piedra Catipan, rios Pacimoni-Yatua, Casiquiare, *Maguire, Wurdack & Bunting 36478, 36479.*

Species Excluded

Pagamea spadicea Pittier, Bol. Soc. Venez, Cienc. Nat. **9**: 123. 1944. = **Psychotria spadicea** (Pittier) Standl. & Steyerm.

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STUDIES IN MEXICAN COMPOSITAE. I. MISCELLANEOUS NEW SPECIES[1]

ARTHUR CRONQUIST

In the autumn of 1962 Dr. Rogers McVaugh and I botanized together over a large part of Mexico, from Coahuila to Chiapas, and to both coasts. Our purposes were compatible but different, and each of us maintained his collection and records separately. My purpose was to learn something about the Compositae of Mexico. Not surprisingly, a few of my collections turn out to represent previously undescribed species. Four of these are described in this paper. The abbreviations of herbaria are those of Lanjouw and Stafleu in Index Herbariorum (1959).

Tithonia pedunculata Cronquist, sp. nov. Fig. 1.

Frutex arborescens 0.6–5 m altus, ramulis leviter hirsuto-strigosis, foliis alternis lanceolatis ovato-lanceolatisve 2–5 cm latis ad basin perspicue subpetiolatis, pedunculis terminalibus 1–2 dm longis folia superantibus; capitula solitaria involucro 13–15 mm alto 3–4-seriato phyllareis extimis angustis acutis, intimis apicem versus membranaceis latis obtusis, ligulis 13–17 (frequenter 13) 2.5–3.5 cm longis, paleis ad apicem angustis luteis cartilagineis floscula superantibus, achaeniis appresso-pilosis pappo ex aristis duobus et squamellis paucis basin versus connatis composito.

Branching, arborescent shrub 0.6–5 m tall, with stems up to nearly 1 dm thick; twigs of the season rather slender, hirsute-strigose; leaves alternate, crowded toward the ends of the branches (beneath the elongate peduncles), sessile or nearly so but with a conspicuous narrow subpetiolar base 2–4 cm long which may be slightly enlarged and clasping at its base, the whole leaf 10–15 cm long and 2–5 cm wide, the expanded part lanceolate or lance-ovate, acute or acuminate, pinnately nerved or obscurely triplinerved, shallowly and obscurely toothed or entire, scabrous or scabrous-hirsute on the upper surface, paler and shortly spreading-villous with crinkled hairs beneath; heads sunflower yellow, solitary on long (1–2 dm) peduncles terminating many of the branches, the peduncles conspicuously surpassing the leaves, hollow distally and slightly inflated; heads rather large, the disk 2–3.5 cm wide as pressed; involucre 13–15 mm high, 3–4-seriate, the bracts, especially the outer, with thickened, cartilaginous and striate base, this giving way abruptly to the more herbaceous or membranous distal portion, the outer bracts relatively narrow and acute, with the terminal portion more or less herbaceous, the inner broader and more obtuse or rounded, with the terminal portion more membranous, the outer bracts somewhat scabrous-hirsute, the inner merely puberulent or subglabrous; rays 13–17 (often 13), 2.5–3.5 cm long, up to nearly 1 cm wide, neutral, with sterile, epappose achenes; receptacular bracts with prominent, narrow, cartilaginous, light yellow tip surpassing the flowers at anthesis and in fruit; achenes of the disk flowers

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[1] Research supported in part by funds from the National Science Foundation.

blackish, appressed-silky, 4–5 mm long; pappus of 2 well developed awn-scales and several shorter broad scales that are connate below and lacerate above.

Type. *Cronquist 9684,* savanna-land hillsides just below the pine zone along the Pan-American highway 42 miles northwest of Tehuantepec, state of Oaxaca, Mexico. Elevation about 2300 feet. Holotype at NY; isotypes at F, GH, MEXU, MICH, TEX, US.

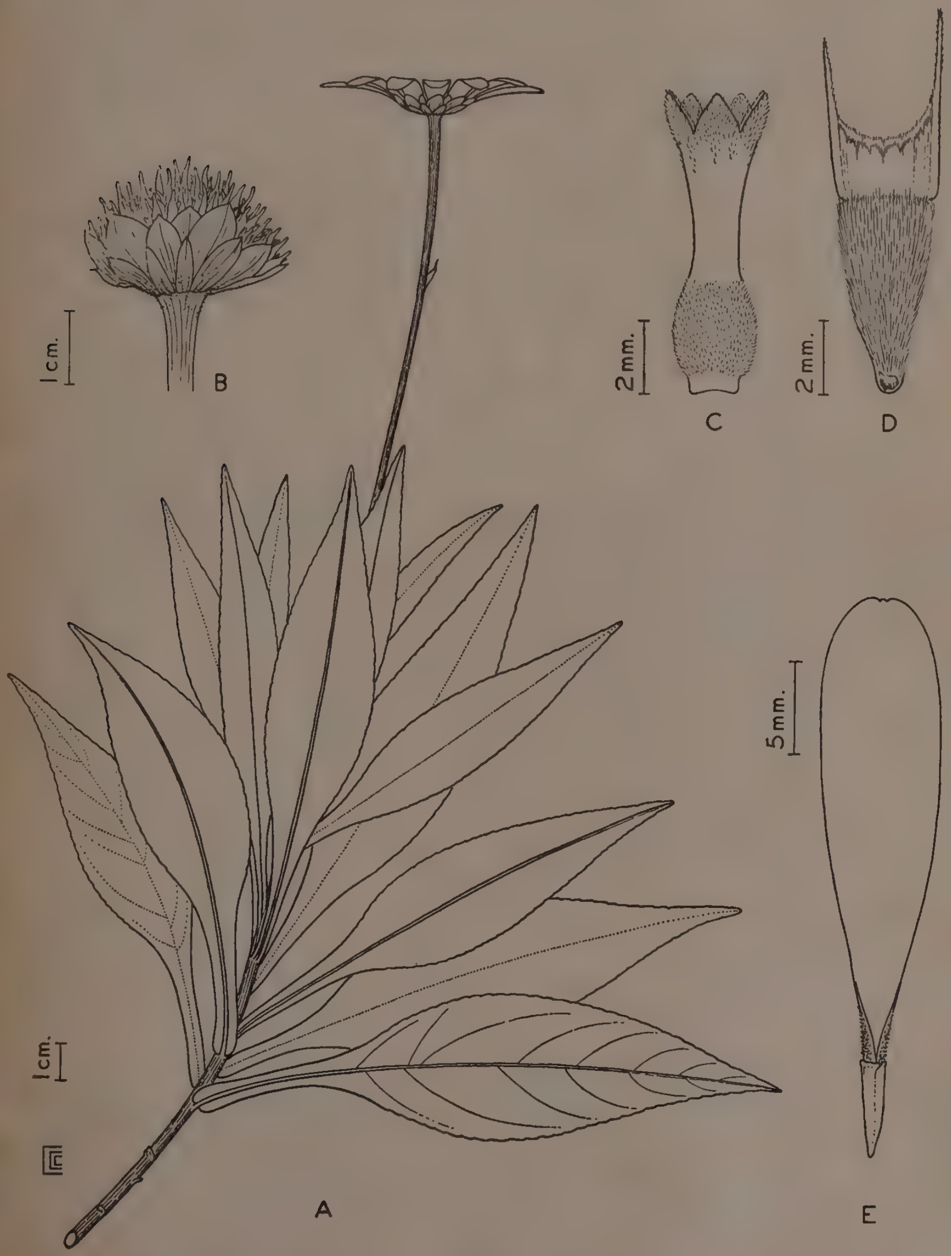

1 cm.
B
2 mm.
C
2 mm.
D
5 mm.
1 cm.
A
E

FIG. 1. *Tithonia pedunculata*, holotype. A, habit. B, maturing head, from which the rays have fallen, as pressed. C, disk corolla. D, disk achene, with pappus. E, ray flower.

T. pedunculata is similar in aspect to the more northern *T. fruticosa* Canby & Rose, of Sonora, Chihuahua, Durango, and Sinaloa, which is likewise a stout shrub with narrow (for the genus) alternate leaves with a petioliform base and with large heads on terminal peduncles. That species, however, is much more conspicuously hairy, the pubescence mostly spreading; its peduncles are short, up to about 1 dm long, and mostly surpassed by the leaves; the outer involucral bracts, like the inner, are relatively broad, with rounded or obtuse tip; and the receptacular bracts are surpassed by the disk flowers. The two species are clearly related and as clearly distinct.

Galinsoga subdiscoidea Cronquist, sp. nov. Fig. 2.

Planta annua depressa 2–5 cm alta caulibus obscure strigosis puberulisve, foliis glabris integris subintegrisve oblanceolatis spathulatisve vel ellipticis usque ad 22 mm longis 8 mm latis vix petiolatis; capitula virido-lutea discoidea vel flosculum unicum femineum vix ligulatum habentia, involucro 3 mm alta achaeniis nigris pappo ex squamellis 10 bene evolutis ca. 1 mm longis ad apicem obtusis truncatisve et ciliolatis composito.

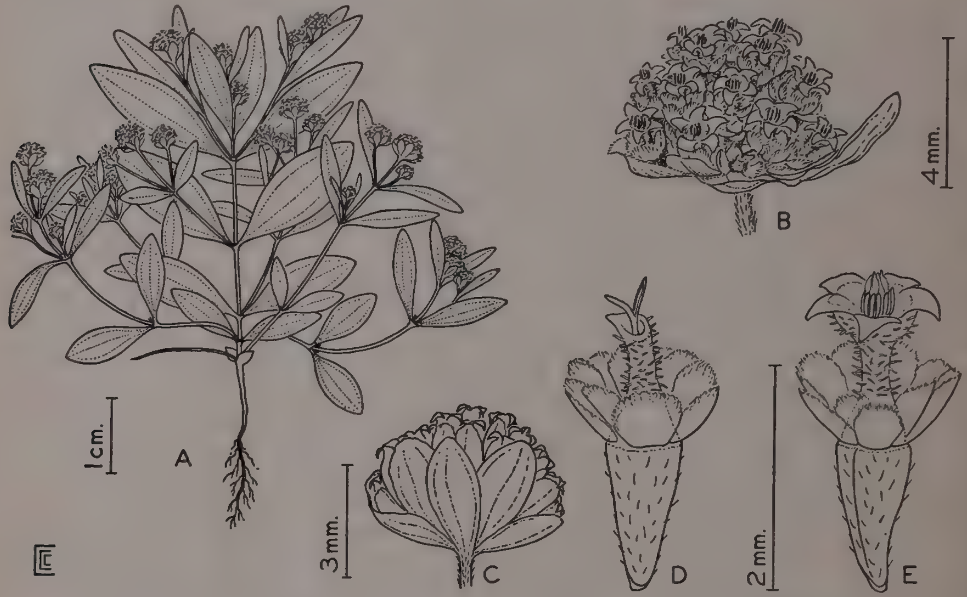


FIG. 2. *Galinsoga subdiscoidea*, holotype. A, habit. B, head, as expanded after boiling. C, head, as pressed. D, pistillate flower. E, disk flower.

Depressed annual only 2–5 cm tall, simple or branched; stem and peduncles thinly and inconspicuously strigose or puberulent, the plants otherwise glabrous; leaves all opposite, entire or nearly so, oblanceolate or spatulate to elliptic or narrowly rhombic, tapering to a narrow and sometimes more or less petiolar base, but not with a definite petiole, up to about 22 mm long and 8 mm wide, tending to be 3-nerved, the uppermost ones smaller and relatively narrower than the others; heads axillary and terminal, on short peduncles up to about 8 mm long, or some of them subsessile, greenish-yellow, discoid or with a single small, inconspicuous, scarcely ligulate pistillate flower, campanulate to hemispheric, the disk mostly 3–5 mm wide, involucre ca. 3 mm high; achenes obconic, black; pappus of about 10 well developed blunt scales a little shorter than the disk corollas, minutely fringed-ciliate distally, that of the pistillate flower similar to that of the disk flowers.

Type. *Cronquist 9583*, in thin soil on rhyolite rock in open pine woods; Sierra Madre Occidental, about 10 miles west of El Salto, state of Durango, Mexico. Elevation about 8800 feet. October 2, 1962. Holotype at NY; isotypes at F, GH, MEXU, MICH, TEX, US, others.

This species is perhaps most closely related to *G. semicalva* (Gray) St. John & White, which was collected at the same time at the same station but is amply distinct. *G. subdiscoidea* differs from all other species of *Galinsoga* in its diminutive habit, in its scarcely petiolate leaves, and in its mostly discoid heads, which are scarcely radiate even when a solitary pistillate flower is present. It is also unusual in being nearly glabrous, although *G. semicalva* approaches it in this respect. It further differs from *G. semicalva* in that the pistillate flower, when present, has a pappus like that of the disk flowers, whereas in *G. semicalva* the ray pappus is much reduced. The peculiar greenish-yellow color of the disk flowers is also different from the more definite yellow of those species of *Galinsoga* which I have observed in the field. The plant is nonetheless a true *Galinsoga,* and no other genus could be stretched to accommodate it.

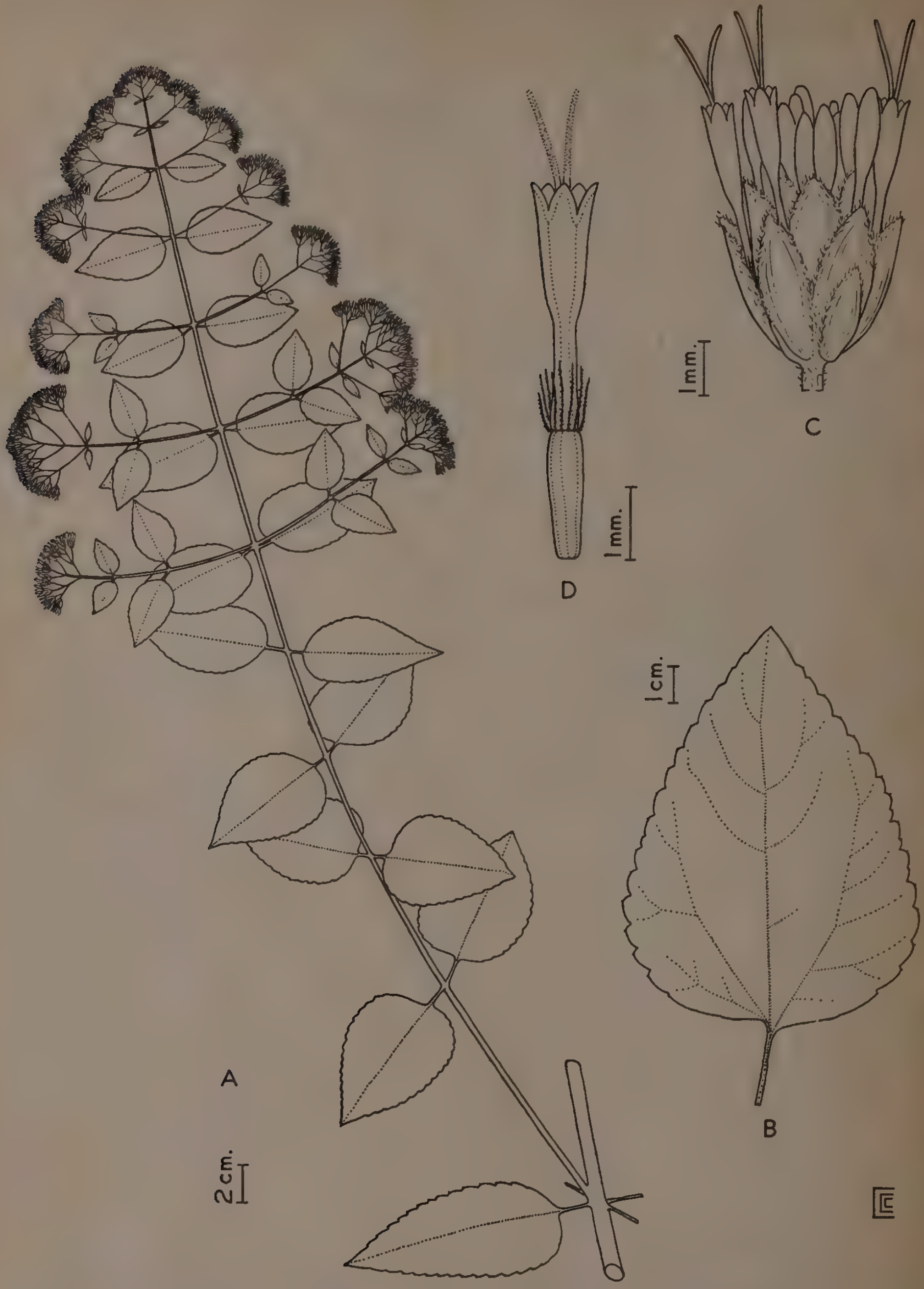
Piptothrix paleacea Crouquist, sp. nov. Fig. 3.

Suffrutex 3–4 m altus caule unico glauco, foliis ovatis subglabris breviter petiolatis caulis principalis quaternatis ramulorum oppositis; capitula plurima in inflorescentia magna foliosa cymoso-paniculata disposita, receptaculo paleaceo, floribus 11–13 albis involucrum perspicue superantibus.

Coarse, arching, single-stemmed semi-shrub 3–4 m tall, the main stem glabrous and glaucous, 2–3 cm thick; leaves whorled in 4's on the main stem, opposite on the flowering branches, rather broadly ovate, with rounded or subcordate base, crenate-serrate, palmately veined, somewhat villous-hirsute (especially proximally) on the midrib and main veins especially beneath, otherwise nearly glabrous, those of the upper part of the main stem up to 11 cm long and 8 cm wide, on a petiole up to 2 cm long, those of the flowering branches smaller, up to about 8 cm long and 6 cm wide, on petioles up to 1 cm long; heads short-pedunculate or sessile, numerous in small cymes arranged in a large, leafy, paniculiform inflorescence; involucre 2.5–3 mm high, the bracts finely and inconspicuously ciliate-margined and slightly glutinous, otherwise glabrous or nearly so; receptacle chaffy, the pales much like the involucral bracts; flowers 11–13, bright white, becoming somewhat ochroleucous in drying, about 3 mm long, conspicuously surpassing the involucre and pales; pappus of about a dozen slender, fragile, finely and remotely but conspicuously barbellate, deciduous bristles that are much shorter than the corolla, only about 1 mm long.

Type. *Cronquist 9775,* on steep slopes in the oak forest on the seaward slope of the mts., 11 road miles southwest of Autlan and 2 road miles southwest of the pass, state of Jalisco, Mexico. Elevation about 4500 feet. November 1, 1962. Holotype at NY; isotypes at F, GH, MEXU, MICH, TEX, US, others.

This species is unique in the genus in having a chaffy receptacle. Additional differences appear when it is compared with any of the other species. It is evidently more robust than the other known species, but herbarium specimens are at first sight much like those of *P. goldmanii* Rob. In field aspect the species is reminiscent of the group of *Eupatoria* to which *Eupatorium areolare* DC. belongs.


A
2 cm.
B
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C
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D
1 mm.

FIG. 3. *Piptothrix paleacea*, holotype. A, habit. B, leaf from upper part of main stem. C, head. D, disk flower.

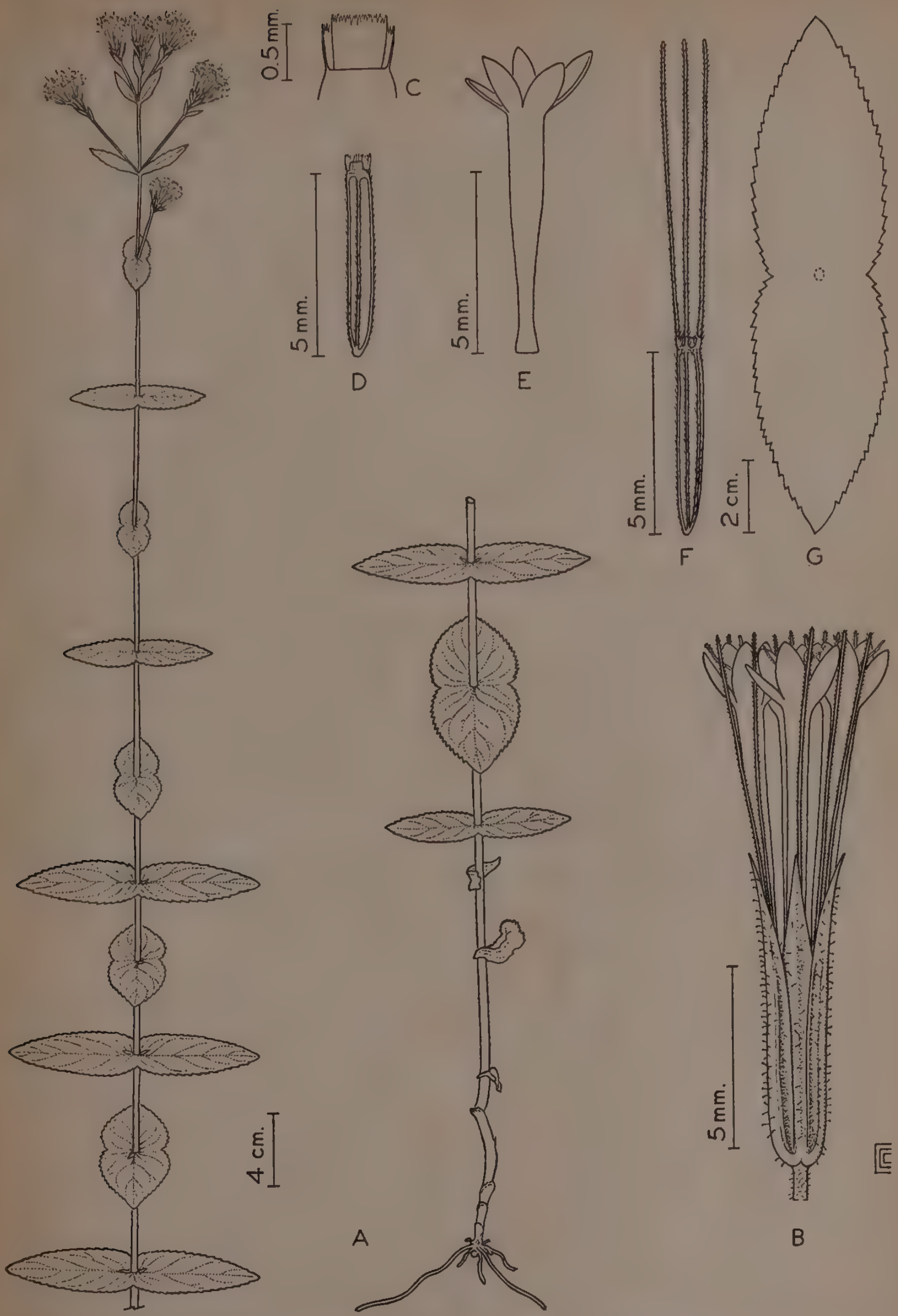
0.5 mm.
C
5 mm.
D
5 mm.
E
5 mm.
F
2 cm.
G
4 cm.
A
5 mm.
B

FIG. 4. *Stevia perfoliata,* holotype. A, habit. B, head. C, D, achene with pappus scales but no awns. E, disk corolla. F, achene with both pappus scales and pappus awns. G, vertical view of outline of a single pair of leaves.

Stevia perfoliata Cronquist, sp. nov. Fig. 4.

Herba perennis ca. 1 m alta omnino glanduloso-pubescens, foliis serratis oblongo-ovatis usque ad 7 cm longis 4.5 cm latis perspicue connato-perfoliatis; capitula plurima conferta sessilia vel breviter pedunculata, involucro 8–9 mm alto bracteis anguste cacuminatis; floribus purpureis corolla fere 1 cm longa, achaeniis 5 mm longis pappo quattuor ex aristis longis tribus et squamellis brevibus tribus, quintius squamellis solis composito.

Fibrous-rooted perennial about 1 m tall, the solitary stem evidently spreading-hairy throughout, many of the hairs, especially the shorter ones, gland-tipped; leaves firm, glandular-hairy like the stem, but the pubescence somewhat shorter and, on the lower surface, sparser; lowermost leaves reduced and deciduous, the others well developed, about a dozen pairs below the inflorescence, up to 7 cm long and 4.5 cm wide, sharply serrate, ovate-oblong, scarcely narrowed at the base, sessile and evidently connate-perfoliate; heads crowded in a round-topped inflorescence about 1 dm wide, sessile or on short peduncles up to 5 mm long; involucre 8–9 mm high, shortly glandular-hirsute or stipitate-glandular, the bracts firm, strongly carinate below, tapering above to a narrow, almost subulate point; corolla purple, 8–9 mm long (dry); achenes black, 5 mm long, hirtellous-scabrous; pappus of 4 achenes in each head composed of 3 long awns about equaling the corolla and 3 alternating short, broad, hyaline scales only 0.5 mm long, of the fifth achene awnless, composed of short scales only.

Type. *Cronquist 9715,* steep, east-facing, calcareous slopes in open, grassy oak-pine woods; Sierra Madre del Sur, about 10 road miles west of Chilpancingo, state of Guerrero, Mexico. Elevation about 5400 feet. October 21, 1962. Holotype at NY.

This species differs from all other Stevias known to me, and certainly from all other North American species, in its evidently connate-perfoliate leaves. Both the general aspect and the technical characters are clearly of *Stevia,* but it does not seem particularly closely related to any other species. Only a few plants were seen, and of these only one was suitable to become a good herbarium specimen. The species is therefore represented in the herbarium only by its holotype.

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